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Where to Purchase

A comprehensive Directory of the leading machinery and supply manufacturers arranged for the convenience of engineers and contractors who may desire to secure catalogs or prices on construction equipment. Where the name of a manufacturer is preceded by a star (*) it indicates that the user of the directory may secure further information regarding the products of this manufacturer by referring to his advertisement in this issue of the Guide. The index to advertisers will be found on page facing the inside back cover.

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*Indiana Air Pump Co., Indianapolis, Ind.
*Nordberg Mfg. Co., Milwaukee, Wis.
*Standard Scale & Supply Co., Pittsburgh, Pa.
*United Iron Works Co., Kansas City, Mo.
*Werthington Pump & Mch. Corp., N. Y. C.
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Hardie-Tynes Mfg. Co., Birmingham, Ala.
Ingersoll-Rand Co., N. Y. C.
Norwalk Iron Works Co., South Norwalk, Conn.
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Stratton & Bragg Co., Petersburg, Va.
Sullivan Mch. Co., Chicago, Ill.
Westinghouse Trac. Brake Co., Wilmerding, Pa.

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*General Electric Co., Schenectady, N. Y.
*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

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Cummer & Son Co., F. D., Cleveland, O.
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*Barber Asphalt Paving Co., Philadelphia, Pa.
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Byers Mach. Co., J. F., Ravenna, Ohio.
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Parsons Co., Newton, Ia.
Waterloo Constr. Mch. Co., Waterloo, Ia.

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*Koehring Machine Co., Milwaukee, Wis.
*Ransome Concrete Machinery Co., Dunellen, N. J.
Electric Welding Co., Pittsburgh, Pa.
Hinman & Co., D. A., Sandwich, Ill.

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Concrete Steel Co., N. Y. C.
Universal Clamp Co., Chicago, Ill.

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Carnegie Steel Co., Pittsburgh, Pa.
Franklin Steel Works, Franklin, Pa.
Gulf States Steel Co., Birmingham, Ala.
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 McMaster-Carr Supply Co., Chicago, Ill.
 Mulconroy Co., Inc., Philadelphia, Pa.
 Pa. Rubber Co., Jeannette, Pa.
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 Southern Supply & Equip. Co., St. Louis, Mo.
 Southern Rubber & Belt Co., Houston, Tex.
 Union Asbestos & Rubber Co., Chicago, Ill.
 Voorhees Rubber Mfg. Co., Jersey City, N. J.
 Wood, Guilford S., Chicago, Ill.

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 Petroleum Iron Works Co., Sharon, Pa.

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 American Gas Furnace Co., N. Y. C.
 Spencer Turbine Co., Hartford, Conn.

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 Cameron & Barkley Co., Charleston, S. C.
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 Boston Bridge Works, Boston, Mass.
 Central States Bridge Co., Indianapolis, Ind.
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 Chesapeake Iron Works, Baltimore, Md.
 Eastern Bridge & Struc. Co., Worcester, Mass.
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 Flour City Orn. Iron Co., Minneapolis, Minn.
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 Hydraulic Steelcraft Co., Cleveland, O.
 Ingalls Iron Works, Birmingham, Ala.
 Inland Steel Co., Chicago, Ill.
 Inter. Steel & Iron Co., Evansville, Ind.
 King Bridge Co., Cleveland, O.
 Lackawanna Bridge Co., Buffalo, N. Y.
 Lewis-Hall Iron Wks., Detroit, Mich.
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 McClintic Marshall Co., Pittsburgh, Pa.
 Milwaukee Bridge Co., Milwaukee, Wis.
 Minn. Steel & Mch. Co., Minneapolis, Minn.
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 Morava Constr. Co., Chicago, Ill.
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 Penn. Bridge Co., Beaver Falls, Pa.
 Richmond Struc. Steel Co., Richmond, Va.
 Riverside Bridge Co., Martins Ferry, O.
 Toledo Bridge & Crane Co., Toledo, O.
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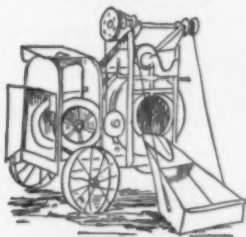
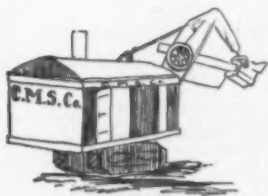
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*Austin Mach. Corp., Chicago, Ill.
 *Hais Mfg. Co., Geo., N. Y. C.
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 Blaw-Knox Co., Pittsburgh, Pa.
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 Byers Mach. Co., J. F., Ravenss, O.
 Hayward Co., N. Y. C.
 Industrial Works, Bay City, Mich.
 Kleiser Co., J. F., Chicago, Ill.
 Lakewood Engineering Co., Cleveland, O.
 Link-Belt Co., Chicago, Ill.
 Orton & Steinbrenner, Chicago, Ill.
 Owen Bucket Co., Cleveland, O.
 Vulcan Iron Works, Jersey City, N. J.
 Williams Co., G. H., Erie, Pa.

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 *Rochester Can Co., Rochester, N. Y.
 Insley Mfg. Co., Indianapolis, Ind.
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- 2—Model 28 Marions. $\frac{3}{4}$ -yd. buckets, traction trucks, Ohio boilers; perfect condition.

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- 10—Western. 36" gauge, 2-way dumps, heavy-duty steel underframe.
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- 4—10"x16" Davenport Four-driver Saddle-tank, 36" gauge.
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 - 1—Austin Trench Back Filler, caterpillar traction.
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- *Marion Steam Shovel Co., Marion, O.
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- *Monaghan Machine Co., Chicago, Ill.
- *Owen Bucket Co., Cleveland, O.
- *Union Iron Works, Inc., Hoboken, N. J.

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- *Kiesler Co., J. F., Chicago, Ill.
- *McMyler Interstate Co., Cleveland, O.
- *Mead-Morrison Mfg. Co., East Boston, Mass.
- *Orton & Steinbrenner Co., Chicago, Ill.
- *Vulcan Iron Works, Jersey City, N. J.

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- *Southern Rome Co., Baltimore, Md.

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- *Petroleum Iron Works Co., Sharon, Pa.

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- *Steel Basket Co., Cedar Rapids, Ia.

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- *Chase Fdry. & Mfg. Co., Columbus, O.
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- *Lakewood Engineering Co., Cleveland, O.
- *Smith Co., T. L., Chicago, Ill.
- *Sterling Wheelbarrow Co., Milwaukee, Wis.
- *Toledo Wheelbarrow Co., Toledo, Ohio.

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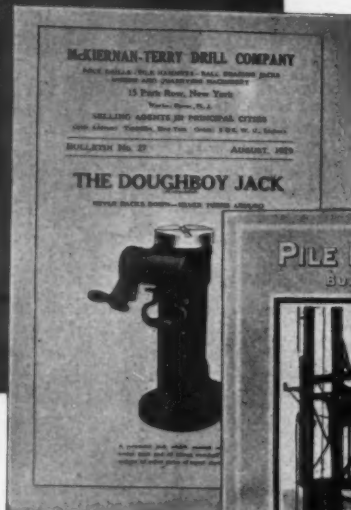
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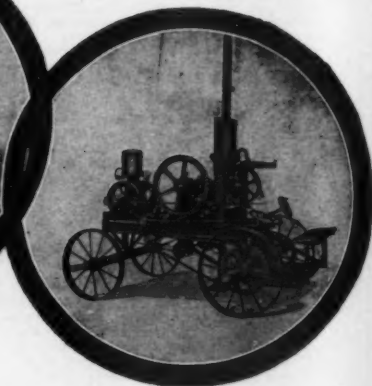
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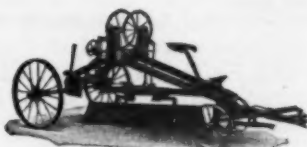
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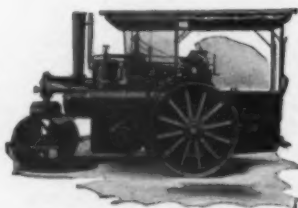
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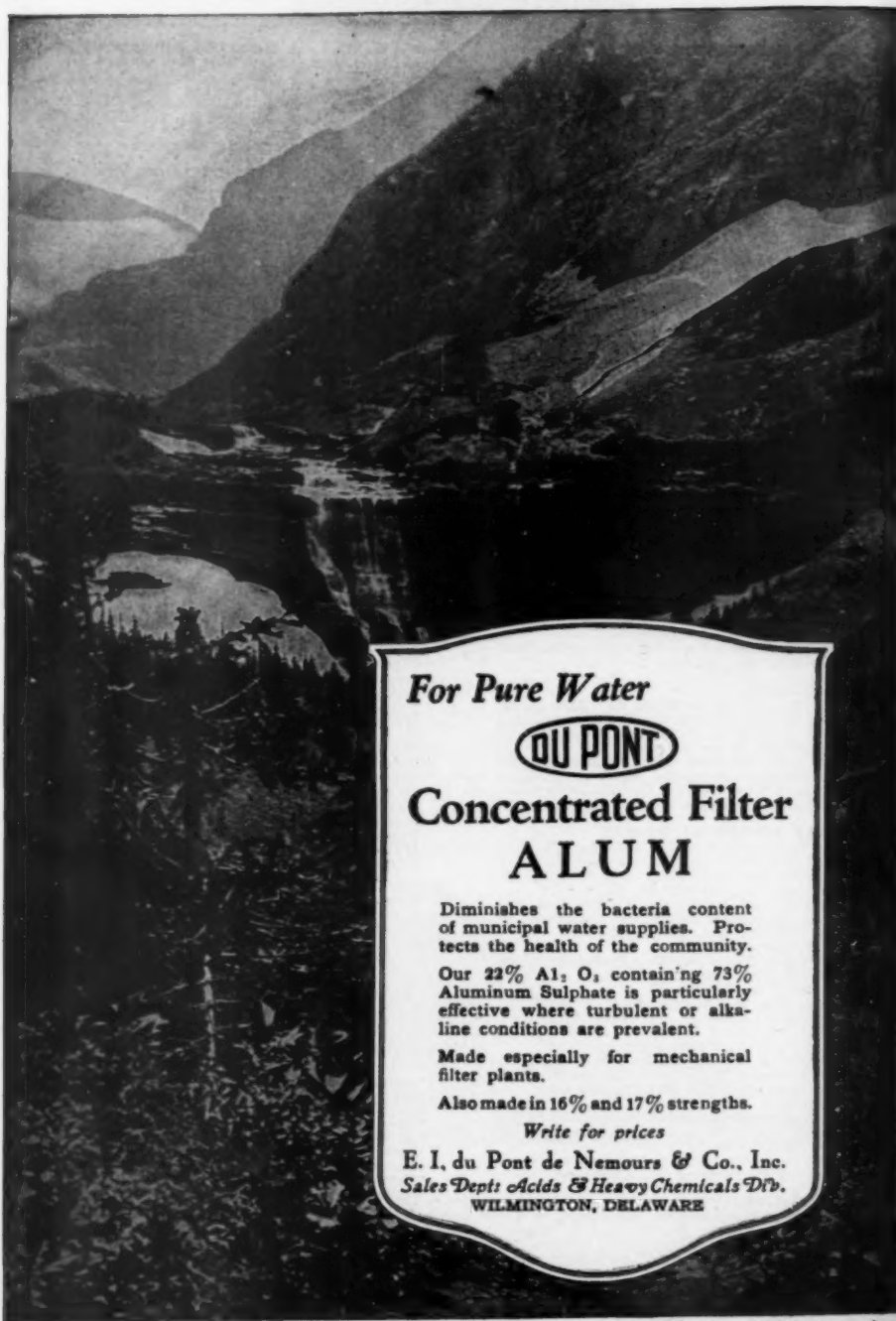
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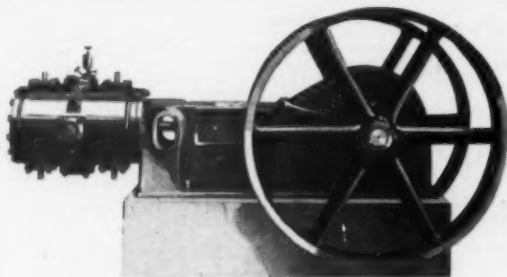
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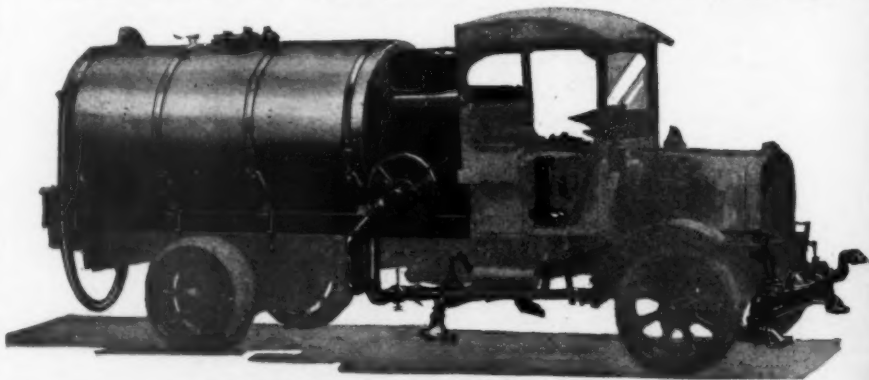
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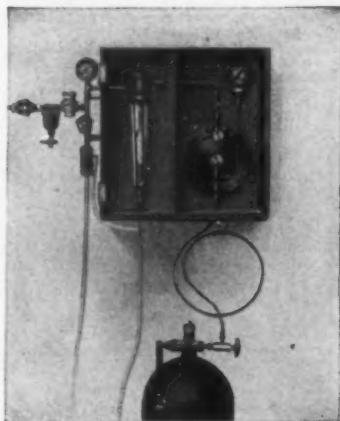
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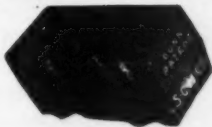
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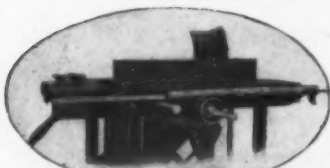
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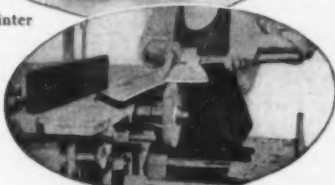
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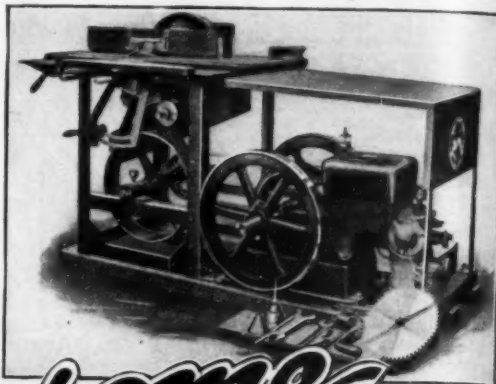
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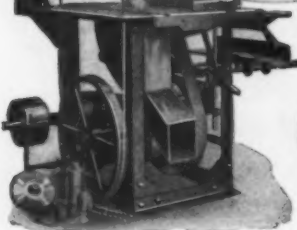
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MONTHLY NEWS AND CLASSIFIED LISTS OF MACHINERY AND SUPPLIES FOR CONTRACTORS, ENGINEERS AND OTHER PURCHASERS OF CONSTRUCTION EQUIPMENT

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Contractors' & Engineers' Purchasing Guide

New York

December, 1920

Engineering and Constructing Organization for Rapid Work

By I. W. McConnell

Vice-President, Dwight P. Robinson & Co., Incorporated

EVERY engineering enterprise in its development goes through some process resembling the following:

First, the conception or vision of the need.

Second, the preliminary study to develop the general facts, including rough estimates of cost.

Third, the business consideration as to feasibility, ending in rejection, or in postponement, or in decision to proceed with the enterprise, or to investigate more thoroughly.

Fourth, the decision to proceed having been reached, construction is ordered.

Once the construction decision is made, it is usually economical to push the construction work at the highest rate which physical limitations will permit. The value of speed may be gauged roughly from savings or gains to be made on three factors, to wit:

1. Carrying charges on the preliminary investment, which preliminary investment frequently may be deferred, either wholly or in part, to a later date if it is known that the construction period can be shortened. This investment will consist of real estate, franchises, permits, etc. In certain types of enterprises this portion of the investment may be as much as half of the total cost, and the saving may be proportionate.
2. Carrying charges on funds required for construction. This may be assumed for convenience as the interest on the construction cost for one-half the construction period at the rate paid for the money.
3. Operating revenue arising from the use of the facility will presumably start

as soon as the construction work is completed. In some cases operating revenue begins prior to total completion; that is, as soon as usable portions are finished, as in the case of storage warehouses or office buildings. By whatever time any predetermined construction program can be shortened, the corresponding operating revenue can be counted as clear gain.

Of these gains the first one is the least tangible and is not determinable in a definite way for the purposes of this discussion. Each case will be a law unto itself in this respect. It is real, however, and should not be regarded purely as a theoretical advantage.

The second gain is tangible and susceptible of accurate determination. For example, a construction program requiring normally two years for completion and utilizing 6 per cent money would save in interest about 3 per cent on the construction cost if the construction program could be shortened to one year.

The third gain, from operating revenue, is the most tangible and usually the largest in amount.

To illustrate, we may look into the case of a steam power station to be built to supply a growing load and to replace less efficient capacity in older plants. The capacity of the new plant may be 50,000 kw., its cost estimated at \$6,000,000. Its annual output may be 240,000,000 kw. h. per year, of which 100,000,000 kw. h. may be load taken

off the older machinery at a net saving in generating cost of three-quarters of a mill per kw. h., and the balance may represent the growth in load sold at a net profit to the station of one-half cent per kw. h. The time for preparing plans and building such a station, under ordinary routine, might be 24 months. If the time from the date of the appropriation of money can be reduced to 15 months, the savings may be considered as follows:

1. Carrying charge on real estate, franchises, etc. intangible	
2. Interest on construction funds— \$6,000,000 at 6% for 4½ months....	\$135,000
3. Production in 9 months— 75,000,000 kw. h. @ 4-mill.	56,250
105,000,000 kw. h. @ 5 mills.	525,000
Total gain	\$716,250

It may be admitted, to eliminate argument, that rush work costs more than work carried on more deliberately. There is, of course, some rate of speed on every job which marks the limit of rational cost, but that rate is usually much higher than people imagine, and such losses as do occur legitimately are largely offset by reduced costs of the overhead and supervisory items of expense. There are many elements which enter into the costs, and frequently the tendency is to load the sins of all upon the speed element.

To Insure Continuous Progress

One of the most important elements in any construction program is that of coordinating the various portions to give logical progress without breaks in the continuity of operation or undue interference by the later items of the work with earlier ones. This implies control from start to finish of the supply of material and equipment to be built into the structures and of the labor and equipment necessary for the construction work at its various stages. The old-fashioned axiom of "a place for everything and everything in its place" is as good a general statement of the ideal as any other. All of the elements tend to go astray under any kind of speed program, but they are more difficult to control under fast schedules than under slow ones.

Every city dweller knows the confusion and delay which follows an interruption to traffic at a busy street intersection. The same kind of confusion follows a break in a stream of production by the displacement of any of its elements. On construction

work such a displacement might be the failure of gravel, sand or cement to arrive for the cement gang; or the breakdown of a derrick or industrial railway; or the necessity of unloading and storing machinery which arrives ahead of its proper sequence and before a place is ready for it. The gangs immediately concerned are thrown out of step, so to speak, and their discomfiture affects contiguous gangs, frequently extending over the entire job.

Cost of Speed

In discussing the so-called excess cost of fast work, a clear distinction should be drawn between failure of coordinate work properly as distinguished from the cost of speed. "Failure to coordinate" not covered by failures due to causes beyond control becomes poor management. "Cost of speed" should be clearly foreseen and understood as a price payable for quicker results. It may be due to premiums for expedited manufacture of material or to higher wages for overtime, or for night work, or for quick deliveries of materials by unusual methods of transportation, such as trucks instead of railroads; or to the use of higher-priced products available at once in lieu of waiting for routine deliveries of lower-priced materials. There is a legitimate cost for speed, but the desire for speed should not be made a cloak for all the vagaries and misfortunes of the job.

Some years ago one of the large power companies lost its principal generating stations by fire. The interests of the public served demanded the utmost speed, and the loss of revenue to the company justified extraordinary methods quite outside the realm of ordinary economics on such work.

The routine method of initiating construction on a new facility is somewhat as follows:

1. Preliminary engineering studies are made as a basis for estimates of cost and for the necessary decisions as to final layout.
2. Complete engineering plans are prepared.
3. Tenders for the work are invited from contractors.
4. Contractors' proposals are received and examined, frequently resulting in changes in plan to meet necessary economies or to incorporate expanding ideas as to requirements. These changes may make it necessary to re-submit the plans to contractors for new bids.

5. The contract or contracts are let under plans and specifications which require the contractor to perform certain definite tasks at fixed prices and in fixed times.

This is the time-honored method, and the only one in a general way open to public officials to carry on their work. For this class of work it is perhaps as generally suitable as any other plan, and, irrespective of suitability, it is the plan which must usually be followed until statutory requirements to that effect are changed.

The most significant date in a construction program is the date when construction work actually begins, for it marks the start from which all procedure must be laid down. Under the older method of contracting construction work, the start cannot be safely made until the contractor is securely tied in a binding contract based upon a complete set of plans and specifications covering the generalities and the details of the work. Thus under this method the time to produce the needed facility divides itself normally into two periods, namely, the period of design and the period of construction, each of which for proper execution requires a reasonable amount of time and neither of which can be cut much below a rational minimum without paying some penalty which may be too serious to contemplate. A frequent penalty of such attempts to reduce the time factor is failure to accomplish the end sought after paying a big price to get it. The construction end is, perhaps, more responsive to rush methods than the design, but even on that end of the work there will be some factor which will present an irreducible minimum which fixes the length of the job from the date when construction starts.

Now, any claim of savings based upon unusual speed in the construction end alone must depend for its realization upon ability

EST. NO.	DESCRIPTION	AMOUNT	TOTALS
522.	Machinery Foundations	34000	
1	Turbine Foundations	11000	45000
2	Auxiliary		
523.	Boiler Plant	860000	
10	Boilers	270000	
11	Boiler Section	80000	
12	Boiler Settings	60000	
20	Superheaters	"	
30	Overalls (Inv. in 501.10)	"	
41	Boiler Section (" " 501.11)	"	
42	Boilers, Cylindrical Grinders, Etc.	150000	
50	Boiler Erection	108000	
9	Miscellaneous	10800	712800
524.	Draft System		
10	Drafts 275 ft.	78000	
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20	Drafts, Overalls & Insulation	44000	
31	Drafts	8800	
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PLATE 1

to select a contractor who can beat customary records, or upon ability to get together a new organization which can do it. The latter alternative has been tried so frequently, without success, that the effort is fairly well established as a risky business. The former alternative has more promise of success, but is still a questionable device, quite as likely to bring disappointment as satisfaction.

The real opportunity to gain time lies in the simultaneous development of plans along with progress in construction. Let us illustrate by an example and set up a comparison of times under each of two methods.

Methods of Gaining Time

The example cited will be that of a manufacturing plant on a new site opening up for the industry a new section of the country. The owner knows the profits of his business and judges the locality to be favorable as to raw material, factory workers and markets for the manufactured product. He decides to proceed. His new plant will con-

sist of separate buildings—power station, office building, main factory building, storage sheds and buildings for raw material, storage for manufactured products, trackage, roads, pavements, and housing facilities for workmen. The owner has no careful estimate of the cost, but he knows in a general way what similar facilities have cost, and he judges that it will require an outlay of \$3,000,000 and that his net operating income from the plant will be \$50,000 per month. It must be practically all finished before operation can begin.

The owner requires:

1. A careful estimate of cost based upon sketch plans and inspection of the site
2. Detail plans for construction
3. Construction of the plant

Let us assume that his own organization is busy and that he recognizes the advantages of employing specialists for special purposes. He knows competent engineers and contractors. He has many methods of procedure open, but one of two is commonly used.

Let us designate as Method No. 1 the method known as fixed price contract. Under it the owner has all plans prepared and approved, after which contracts are let upon the plans as prepared. Let us designate as Method No. 2 the method of carrying on the development of plans as the progress of construction work requires them. The following tabulation will show a comparison of the time elements entering into various phases of this work under a relatively high-speed program in the two cases:

METHOD NO. 1

Items	Elapsed Time from the Date on Which Owner Gives Authority to Proceed	
	Time Required Weeks	Accum. Total Time Weeks
Estimate of cost.....	2	2
Preparation of plans.....	12	14
Request for bids.....	2	16
Considerations of proposals...	2	18
Signature of contracts.....	2	20
Construction	50	70

METHOD NO. 2

Items	Elapsed Time from the Date on Which Owner Gives Authority to Proceed	
	Time Required Weeks	Accum. Total Time Weeks
Estimate of cost.....	2	2
Preparation of plans.....	—	No time loss
Request for bids.....	—	—
Considerations of proposals...	2	4
Signature of contracts.....	—	—
Construction	50	54

The result will be the following gains:

Interest on construction cost— \$3,000,000 at 6% for 2 months.....	\$ 30,000
Operating revenue— \$50,000 per month for 4 months.....	200,000
Total	\$230,000

The indication of sixteen weeks' gain is not fictitious, for no time need be lost in waiting for plans after the decision to proceed is reached except that necessary to select a contractor. Neither does the gain imply undue haste on plans or on construction. It does imply careful coördination, which in turn implies experienced and capable men. There will be no spare time for experiments or to break in new men. If a contractor can be had who can also prepare the plans, there will be that additional concentration of responsibility which is desirable. Necessarily such a program must be carried on under some "cost plus" form of contract, which implies that the owner and his organization will cooperate in every possible way to expedite the work.

As soon as the contractor is selected he can begin at once to move his outfit to the job, to make provision for bunk houses and commissary if needed, to place contracts for construction equipment, material and supplies, to lay out roads, build tracks, shops, warehouses and sheds, and in general to get ready for the actual erection of structures. Working plans of the plant to be built are not necessary at this stage.

By the time the construction force is ready for foundation plans, the plans can be ready, and thereafter, step by step, as the work advances, the plans for further work can come out ahead of the construction need. On such a program the full plans will not be complete much ahead of the date of operation of the plant. Close co-ordination between designers and constructors must be maintained to preserve an orderly and logical progress without breaks in the continuity.

The Documents Needed in Supervision

From the standpoint of overall supervision there are four documents which in the author's judgment give the essentials.

The first is the official estimate of cost. Plate 1 shows a typical sheet from this document upon which the requisition for funds is based, and should be in the owner's hands in some form from the start of the job. It follows from this that it should be accurate and include all items entering

into the work. It should be under constant study and revision, expanding in detail as the plans progress and orders for material and equipment are placed and costs become established. The last official estimate furnished when the job is done should be a fairly complete statement of the actual cost of the work.

The second document is the progress chart. Plate 2 shows the form and detail of the general progress chart used for the Cheswick Power Company's Colfax Station. It is, of course, supplemented by much detail in the form of straight line reports, cost account records, and such administrative data as may be required from time to time by executives up and down the line.

The third document is the Working Schedule. Plate 3 shows a specimen sheet. It serves two purposes. In the first place, it should be made up for any particular job from bogey sheets, which carry the name of every kind of item entering into that kind of job. This serves as a reminder to the compiler and insures measurably against omissions of sufficient consequence to break

up progress. In the second place, its principal function is to assign definite responsibility for performance on every item entering into the work. By following it up from time to time with the necessary revisions, a production clerk can call attention to lagging items and make such revisions as may be required.

The fourth document is the organization chart for the job. It indicates at any time the general scope of the work as of that date, and the changing assignments will indicate to a practiced eye the progress of the job.

These four documents, as before stated, are the basis of overall supervision. When such a job is secured, the first thing done is to assign the principal men to the various tasks involved. A general conference on requirements gives each principal man the cue as to how to proceed. One man is made sponsor for the engineering end, and to him falls the task of laying out the production schedule for plans, of keeping in touch with all phases of the design and taking such steps as may be necessary to bring up lagging sections, to straighten out conflicts,

[illegible]

PLATE 2

E - Eng. Dept.
J - Constr. Dept. (Local)
S - Sub Contractor
E - E.T. to over. by letter
C - Client
Form No. 69

DWINN P. ROBINSON AND COMPANY, INC.

Initials Date

WORKING SCHEDULE

MCH: _____

Work For Chemical Power Co. J.O. #11 ELCO: _____

Work On Gulf Power Station WYDO: _____

Appd. Constr.	Date	Appd. Eng.	Date	DETAIL RECORD OF ITEM				
ITEM				PLANS	SPECIFICATIONS	BILL OF MTL.	PURCHASING	CONTRACT
Cranes	X	X	X	X	X	X	X	X
Feeders	X	X	X	X	X	X	X	X
Bucket Elevators	X	X	X	X	X	X	X	X
Belt conveyors	X	X	X	X	X	X	X	X
Coal Carries	X	X	X	X	X	X	X	X
Coal Gates	X	X	X	X	X	X	X	X
Ash Gates	X	X	X	X	X	X	X	X
Coal Hoppers	X	X	X	X	X	X	X	X
Extension Hoppers	X	X	X	X	X	X	X	X
Main Inlet-conveyors	X	X	X	X	X	X	X	X
Extension Feeds	X	X	X	X	X	X	X	X
Smokers	X	X	X	X	X	X	X	X
Air Washers	X	X	X	X	X	X	X	X

PLATE 3

and, in general, to keep the development of the design end in logical order. Another man goes to the field with full authority as construction superintendent and takes up the preliminary tasks connected with his office work, engineering layouts, construction equipment, transportation, labor, accommodations for workmen, sanitary requirements, police regulations, flood protection, and the thousand and one details which enter into such work. Responsibility for purchases must be located and clearly understood. It is a sign of bad luck to come to the day to begin to build concrete forms and find, for

example, that no one has bought wire for wiring them, and that there is none to be had for two weeks. Purchases must be expedited, failure to perform must be forestalled, shifts and expedients must be invented to get out of tight holes, and all the time the plan for the future must be closely studied. Somehow or other human affairs appear never to run ahead of schedule except on the destructive side. I have never known a constructive effort to start spontaneously or to keep going at schedule rates unless it is pushed vigorously all the time.

ACKNOWLEDGMENT.—From a J. E. Aldred lecture, 1919-20, at Johns Hopkins University, Baltimore, Md.



CRANE MANUFACTURED BY INDUSTRIAL WORKS, BAY CITY, MICH.,
OPERATING ON CELLAR EXCAVATION WITH A HAYWARD BUCKET

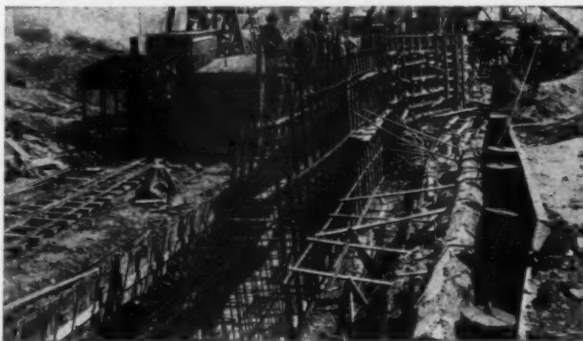
Flood Prevention by Use of a Concrete Spillway Wall

By D. W. McGrath & Sons, Columbus, Ohio

THE flood of 1913 at Columbus, Ohio, is probably well remembered by most people. At that time the waters of the Scioto River flooded over portions of the city, causing a great calamity. The property loss was estimated at \$5,000,000, and action was immediately taken to prevent another such flood, which might cause even greater damage and loss of life.

One of these flood-prevention measures was the straightening and widening of the river through the city of Columbus. The river winds through a low alluvial plain. The channel has sufficient cross-section to allow for the passage of all waters when the stage of the river is normal. However, spring and winter freshets had caused many disastrous floods.

One of the very interesting and important structures being built to prevent a recurrence of floods and its consequent calamity is the great concrete spillway wall. This



VIEW SHOWING THE SEQUENCE OF WALL CONSTRUCTION—STEEL, ERECTING FORMS, AND PLACING CONCRETE

wall is very clearly shown on page 48. The other views show erection of forms and transportation facilities for bringing material to the concreting plant. The wall has been spoken of as a "safety valve." It has a length of 1,200 feet, a height of from 25 to 33 feet, and a base width of 21 feet. The entire structure is supported by wooden piles. It is expected that during extreme floods the river will overflow this 1,200-foot crest formed by the reinforced concrete cantilever retaining wall. In this way the overflow will be spread over a wide area, thereby preventing a volume and velocity which would have disastrous effects on a part of the city if such a wall was not constructed. The construction is being carried in back of the old level. The sand is loaded into bins either from the cars or the stock pile. The stock pile is shown at the left in the last illustration. The strong, high-level, standard-gauge track is also shown between the derrick and the concrete wall. On this track the material is delivered. The



PHOTOGRAPHS SHOWING FORMS AND STEEL REINFORCING RODS IN PLACE

Note railroad track used for conveying concreting materials



THE CONCRETE SPILLWAY WALL AT COLUMBUS, OHIO

material bins are on the river side of the wall. Batch cars on narrow-gauge

appearance when the forms are removed.

ACKNOWLEDGMENT.—From the *Contractor's Atlas*.

tracks, pulled by a Ford locomotive, are placed under the bins for loading and hauled to the traveling concrete plant. The plant can be seen in the background of the view on page 47 on the river side of the wall and consists of a concrete mixer lower boom and chutes mounted on a portable foundation.

A 1:2:4 concrete is used with 7 per cent by weight of hydrated lime. Successful use is being made of steel forms manufactured by the Hydraulic Steel Craft Company. The forms are rapidly placed and the finished concrete is of good appearance when the forms are removed.

Hauling Contractor Approves His New Truck

When a contractor buys a $3\frac{1}{2}$ -ton truck equipped with a wood hydraulic hoist and steel dump body which has a restricted tail gate device permitting the spreading of the load if desired, and then goes ahead and puts a load of 5 tons and 200 pounds on it, as shown in the accompanying illustration, he surely has much faith in the truck. R. H. Griffith, a hauling contractor in Carey, Ohio, purchased this Tiffin truck in May, 1919, and drove 12,000

miles in less than six months, hauling from 5 to 6 tons of crushed stone per load in road construction work over the usual rough roads a man encounters in such jobs. Mr. Griffith writes that the good part of it is that he had to pay only \$14.20 for repairs, having replaced one fan belt and one spring leaf. He says that he has never had to take the crank case off and there is not a loose bearing or knock of any kind in the motor.



A CASE WHERE OVERLOADING PAID THE CONTRACTOR, BUT HE WATCHED HIS TRUCK AND TOOK CARE OF IT

Waterproofing Concrete Structures

Sub-Level Waterproofing by the Minwax Process

THE following discussion of methods of sub-level waterproofing is offered for consideration. Even though this analysis is general, still it gives a good outline of the subject of waterproofing below grade. The first division into integral and membranous systems defines the two basic methods of waterproofing, which have produced extensive discussions for some time.

Integral Waterproofing

The integral system of waterproofing has been very thoroughly investigated by such organizations and bureaus as the American Society for Testing Materials, the United States Bureau of Standards, the Association of American Railway Engineers and the American Society of Civil Engineers. The almost unanimous opinion of these investigating bodies has been unfavorable to the integral system of waterproofing, in that it has gen-

erally failed to produce the result desired. The Committee on Concrete and Reinforced Concrete of the American Society of Civil Engineers reported to the Society in January, 1917, as follows:

"Though compounds of various kinds have been mixed with the concrete or applied as a wash to the surface in an effort to offset this defect (permeability of concrete), these expedients have generally been disappointing for the reason that many of these compounds have at best but temporary value, and, in time, lose their power of imparting impermeability to the concrete."

There is one fatal defect in the integral systems of waterproofing—they fail with the wall in which or on which they are used. They make no provision for expansion or contraction and none for settlement cracks in the wall itself. When any of these occur, the waterproofing fails.



THE DETROIT SUPERIOR BRIDGE, CLEVELAND, OHIO, BOTH DECKS OF WHICH WERE WATERPROOFED BY THE MINWAX SYSTEM, WITH THE EXCEPTION OF THE STEEL ARCH SPAN, WHICH WAS OPEN-DECK CONSTRUCTION AND NOT WATERPROOFED

The waterproofing on the upper deck was covered with an inch of sand cushion granite block, placed and grouted. The lower deck was waterproofed, protected with 1½ inches of asphaltic mastic and the ballast for the street railroad placed. The work was done in 1917, started in July and continued to the latter part of November

Membranous Waterproofing

This is one system of waterproofing in which the promise of theory is sustained by results in practice. A clear understanding of all factors which make for the successful membranous waterproofing system, demands that the two elements in the system, namely, plying cement and membrane, be separately and fully understood.

The three classes of plying cements marketed for waterproofing purposes are rubber compounds, coal tar pitch and asphalts.

Rubber compounds have found very limited use, owing in some measure to their excessive cost. Cost, however, is not the only determining factor. Rubber, like any other vegetable compound, if not adequately protected will oxidize, thus losing its life or stability and nullifying the value of the membrane.

For many years, coal tar has been used largely as a waterproof cement, chiefly because for a long time it was the only material refined for this purpose. It has been found in many cases, however, that coal tar pitch has not proved sufficiently stable and has become hard and brittle, thus not retaining its essential qualities as a cementing agent for the membrane.

There remains only one choice of plying cement, namely, asphalt, which may be divided into two classes.

Compound or fluxed asphalt may be dismissed at once, because the base of these, which is synthetic and not natural, is usually a rock asphalt which is cut back to plastic form by means of a fluxing oil. The selection of a waterproofing cement is therefore narrowed down to natural asphalts, which are well known for their enduring qualities, high melting point, physical and chemical stability, maximum ductility, extreme toughness, minimum susceptibility to temperature changes between 0 and 100 degrees Fahrenheit, and minimum loss of inherent qualities through heating.

The Membrane

The second part of the waterproofing blanket, the part which, while it does not itself waterproof, yet performs a function as important as that of the plying cement, is the membrane. These two factors in the waterproofing equation are entirely interdependent.

The membrane is a binder only, and as such its function is to hold in place the asphalt which is to shed or exclude water. In course of application, membrane and cement are, or should be, so firmly bonded together that they are practically one. Consequently, any movement occurring in one must occur simultaneously in the other. In so far as such a thing is possible, therefore, the qualities of the membrane should be the same as those of the plying cement.

Proper ductility in the cement over a wide range of temperature means that it must remain firm and elastic under extremes of weather, at all times capable of resisting fracture by shock or vibration, and capable also of yielding or stretching under deflection or

movement of the concrete base. While expansion joints eventually take care of mass movements, they do not compensate such movement immediately. The movement at the expansion joint is merely the summation of an indefinite number of minute movements throughout the concrete body, each of which is imparted to the waterproofing blanket bonded to the base. If the ductile asphalt be encased between binders of rigid, non-elastic membrane, the latter will fracture under these movements, and all the advantages of a ductile cement will be lost.

Another point to be considered in relation to the membrane is that it is better to eliminate the possibility of chemical or electrochemical action between two different substances in contact. The material used as a saturant should be the same as the material with which the membrane is applied. Under no circumstances should bitumen solvents be used in this saturation process. It is quite common practice to treat membranes, such as felts and burlaps, by immersing them in a bath of asphalt, liquified by a petroleum residue. The result is a saturation made up largely of petroleum residue, which, being a bitumen solvent, eventually reacts destructively on the plying cement.

The membrane which has been longest in use is wool felt. The most current objections to the use of felt are its lack of flexibility with its consequent inability to secure close conformity with the surface to be waterproofed; its lack of tensile strength, through which its function as a binder is sacrificed; its lack of elasticity, with the resultant inability to stretch without fracture when the base expands or when cracks and crevices occur.

Asbestos felt, another membrane, is composed of splinters or slivers of crude asbestos. This so-called fiber is perfectly straight and will not curl up and mat like wool fiber in the making of the felt. Consequently, in making a sheet of asbestos felt, the asbestos particles must be pressed in a cement of some substance soluble in water. This tends to make the membrane weak and brittle and not sufficiently reliable for waterproofing work.

The one advantage which burlap appears to have over felt as a waterproofing membrane is its greater tensile strength and flexibility. This, however, is an advantage of more value in applying the waterproofing than in assuring satisfactory results. Burlap is jute, and water, even the moisture in the air, will destroy its vegetable fibers.

Cotton cloth has been found to be about the only membrane not open to the objections cited against felts and burlaps. This material is pure cellulose and as such is not affected by water, whether alkali or not, to anything like the same extent as burlap. But, like any vegetable substance, cotton will eventually be rotted by water unless adequately protected. Such protection can be given in only one way, namely, by saturation with some preservative which will exclude moisture. This must be a real saturation, not a mere surface coating of the fibers. Cotton can be thoroughly saturated

with asphalt without the use of any bitumen solvent, so that every fiber will be completely impregnated with the preservative.

The Minwax System

The Minwax system of waterproofing is a membranous system, using two layers or plies of saturated cotton cloth laid in and cemented with Minwax hard waterproofing. The re-

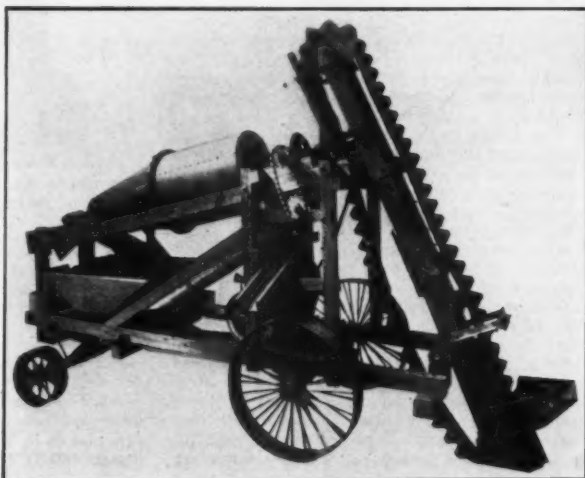
sultant waterproofing course is an impervious, integrated blanket or sheathing made up of two layers of waterproof cement and two layers of cloth. This sheathing is tough, strong, elastic, flexible, practically puncture-proof, and, so far as observations extending over eleven years indicate, free from deterioration and effective as a waterproofing medium.

A Handy Portable Plant for Gravel Washing

Very frequently a contractor is called upon to make use of small local gravel banks for a short time in road construction or building work. It is both expensive and time-consuming to have to convey the gravel by truck or wagon to some central plant at a considerable distance or to screen and wash it by hand.

The Link-Belt Company, Chicago, Ill., has developed the portable gravel washer plant illustrated herewith, which may be readily run from bank to bank on road work where a large-size plant would not prove economical. This washing plant consists of an elevator, preliminary scrubber, screen and sand dewatering device, all mounted on broad-rimmed metal wheels.

The elevator is composed of heavy steel buckets mounted on a single-strand chain, and the elevator frame is so constructed that it can be folded up readily when the machine is to be moved. The folding is readily handled by a small hand winch. The scrubber and screen consist of a cylinder mounted on the same shaft and divided into compartments with lifting vanes on the inner circumference of the shell. These vanes are so arranged that the material is very thoroughly agitated and washed before it enters the screen. The latter is arranged to divide the material into one



A PORTABLE SAND AND GRAVEL WASHER THAT IS PROVING A GREAT HELP TO BOTH LARGE AND SMALL CONTRACTORS

grade of sand and one grade of gravel and to remove all oversize stone. The sand and water flows from the screen into a settling tank, from which the dirty water overflows at the end, and the sand is dewatered by a screw conveyor.

The complete plant is driven by a gasoline engine mounted on the same heavy frame as the machine and connected by sturdy gears and drive chain. The normal capacity of this machine is 10 cubic yards of pit run material per hour.

Rickard and Sloan Move

In an illustrated pamphlet entitled "Treking," Rickard & Sloan, Inc., advertising agents, formerly located in the *Evening Post* Building, New York City, announce their removal to 25 Spruce Street, New York City. The pamphlet describes the development of this company since its organization in 1912, when it occupied one room in the *Evening Post* Building. Among the clients of Rickard & Sloan in the

construction field are Easton Car & Construction Company, Easton, Pa., industrial cars and railways; Hayward Company, New York, digging machinery; Jenkins Brothers, New York, valves and packing; Lea-Courtenay Company, Newark, N. J., centrifugal pumps; Pulsometer Steam Pump Company, New York, pumps; Waterbury Company, New York, wire and fibre rope.

A New Drill-Steel Sharpener

A NEW compressed-air-operated drill-steel sharpener machine known as the I-R No. 50 Sharpener, has been developed by the Ingersoll-Rand Company, 11 Broadway, New York. This machine embodies a number of new and distinctive features, some of which are included in the description given below.

This sharpener was designed primarily to rapidly and exactly sharpen and shank drill steel such as cruciform steel up to 2 inches in diameter, or round, hexagon, octagon, quarter-octagon, auger or spiral steel up to 1 7/8 inches in diameter. However, it has performed so many other tasks that "Drill Steel Sharpener" is almost a misnomer. When fitted with special devices, it will forge bolt-heads, pins, stanchions, etc.; in fact, nearly two hundred different products have been made by this machine.

The single lever, which controls all the operations of the machine, is fitted with a safety locking device. This prevents accidents because of the impossibility of operating the machine unless the lock is released—an excellent improvement. The throttle valve is of the balanced-spool type, operates easily and quickly, is positive and instantaneous in its action.

The hammer cylinder is an improved valveless type of hammer drill cylinder. This construction permits the free-moving hammer to deliver exceedingly fast and powerful blows against the end of the dolly, upsetting the steel and so forming the bits and shanks with extreme rapidity. This may be more easily understood when it is mentioned that its capacity is about 20 per cent greater than the Leyner



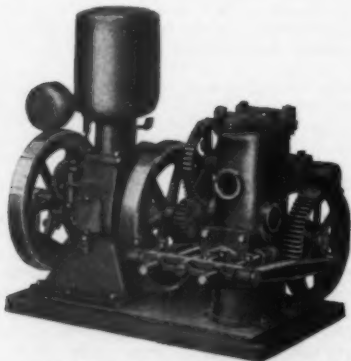
A DRILL SHARPENER THAT IS GOOD FOR DOZENS OF OTHER JOBS

No. 5 Sharpener.

The base must have sufficient strength to withstand the severe strains and shocks met with in its everyday work. Sufficient attention has not been given to this in the past, with the result that base breakage—while not usual—has been all too common. A glance at the accompanying illustration will show how substantial and rigid is the base. It needs absolutely no foundation with the exception of a few planks to level it properly, and is not even bolted rigidly to them.

An Economical Large-Volume Pump

A NEW pump manufactured by the Humphries Manufacturing Company, Mansfield, Ohio, which, according to manufac-



A COMPACT AND ECONOMICAL PUMP

turers' test under actual working conditions, requires less horse-power per gallon of water pumped than any similar type of pump. One of the particular construction features of this pump is that the base, cylinder, split box bearings, valve and air chambers are cast in one piece. This type of unit construction was based on the excellent results achieved by automobile engineers in the use of unit construction. The unified base has four substantial floor lugs and is reinforced to meet exceptional strains or jarring. In order to reach the valves, it is only necessary to loosen two bolts to remove the port caps, thus permitting examination of the valves at any time. The No. 3 pump, having a plunger diameter of 3 inches, has an hourly capacity of 720 gallons at the normal speed of 40 r. p. m. This pump is so flexible that it has a capacity of 1,300 gallons per hour at the maximum speed of 70 r. p. m. The larger pump, having a 5-inch diameter plunger, has a normal capacity of 2,240 gallons per hour at 40 r. p. m., but can be speeded up to 50 r. p. m. with an hourly capacity of 2,550

gallons. Because of this variable capacity this pump has a distinct advantage over any others now on the market, as it makes it unnecessary to have more than two sizes in stock. By casting the main bearings in one piece with the base, cylinder and air chamber castings, a true alignment is obtained, the driving arms are straight, giving a straight-line thrust from the wrist pin to the crosshead. Two cold-rolled steel guide rods, securely fastened to the cylinder body by two lugs on each side, hold the piston rod in true alignment, preventing side strain and cutting of the rod. Numerous other advantages, such as the large and direct

waterways, the ease with which the pump can be converted into a hydro-pneumatic pump, and other features, make this machine one of interest. The illustration given herewith shows one of these pumps direct-connected to a gasoline engine. A drip trough is provided entirely around the subbase to catch waste water and oil. The drain hole of the trough is fitted for $\frac{1}{4}$ -inch iron pipe and can be piped to sewerage or water system if desired. This pump is also furnished for motor-drive or direct-connected type T engine with Bosch magneto, mounted on steel skids or a steel truck when desired.

A New Cleaning Apparatus for Catch-Basins

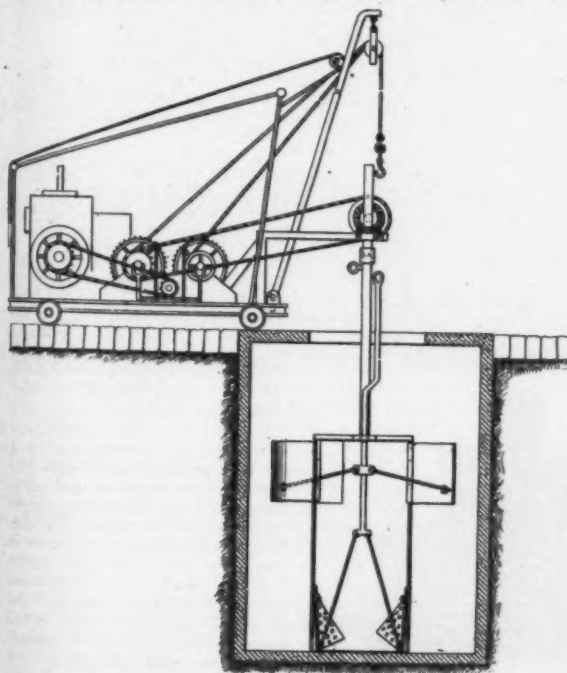
THE trials and tribulations of catch-basin cleaning are altogether too well known to the average man, for as he travels along the street he very frequently sees the mass of filth which is hauled out of the catch-basins by the cleaners, spilled over the sidewalk and dumped into a near-by wagon. Recently a machine has been invented by Patrick J. Healey, Grand Central Palace, New York, for cleaning catch-basins so that it is unnecessary for a workman to enter the basin, and to readily remove the filth in a cleanly manner. It is claimed that this machine will remove all ma-

terial even though it may be solidly packed in the basin. The machine is simple and rugged in construction, to withstand the rough usage to which it will be put.

The machine is operated by a double drop hoist derrick, the later projecting over the manhole opening and holding a rotating spindle operated through beveled gears and chains. The cleaning element is a bucket formed with an open-ended cylinder or drum, rigidly connected to the operating shaft. The lower extremity of the drum is cut away so as to form plows or cutters. Immediately above these

cutters are perforated doors, which are hinged to permit the material to rise and drain on them. Wings or agitator blades are attached also to the lower portion of the cylinder to aid in bringing in the loose material to the bucket.

In operating the apparatus, the bucket cleaner is lowered into the catch-basin, the weight of the bucket holding the agitator blades and doors closed. The bucket is lowered until the lower extremity comes in contact with the refuse covering the bottom of the basin. The lifting cable is then detached, permitting the doors and agitator blades to open because of their weight. The machine is then attached to the main shaft to the drive from the double-drum engine which rotates the bucket cleaner, plows or cutters loosening the material and the blades removing solid matter which has adhered to the sides of the basin. Thus mud and other refuse is deposited within the bucket cleaner either through the open doors or through the openings made by the extension of the agitator blades. In



A RECENT DEVELOPMENT IN CATCH-BASIN CLEANING EQUIPMENT

order to permit the bucket cleaner to dig which permits it to drop at the same time it is digging. As soon as the bucket becomes filled with refuse, the coupling is disconnected into the material, the shaft has a sliding joint

and the bucket raised by the derick, the perforated holes permitting water to drain through back into the basin rather than to be deposited in the cart which is to remove the material.

Welded Road Tar Kettles

IN purchasing a road tar kettle or asphalt heater the contractor naturally looks for points in which the article excels. He does not want a kettle which will leak, and he does want one which will give uniform heating without danger of burning. The combination heater and dryer shown in the accompanying illustration, manufactured by Connery and Co., 4000 North Second Street, Philadelphia, Pa., is especially adapted for street repair work by contractors and municipalities. It is composed of a fire cylinder of $\frac{3}{4}$ -inch boiler plate, with welded and thoroughly reinforced seams. The cylindrical shape insures maximum heating surface and strength and prevents warping and collapsing. The drying compartment is so arranged as to allow any quantity of dried sand or gravel to pass. The adjustable lever at the rear regulates the flow of the dried material or holds the entire body until the material is sufficiently dried for use. There is no wheel interference when the material is dumped. The curved sides insure free movement, maximum strength and a proper heating surface. The



A COMBINED TAR KETTLE AND SAND DRYER FOR ROAD WORK

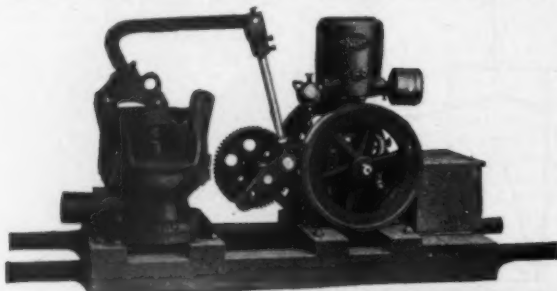
tar and asphalt tank has a semi-spherical bottom to insure equal heating. The tank itself is readily moved for cleaning, without interfering with the work of the dryer. One furnace so arranged as to give sufficient heat serves both the dryer and the tar kettle. The grate bars are of cast iron and the cleaning door is located at the front.

Diaphragm Pump for Muddy Waters

PUMPING muddy and gritty waters from sewer trenches, basements or places where there have been breaks in water-mains, is a service that plays havoc with most pumps. The Deming Company, Salem, Ohio, has developed the power diaphragm pump shown herewith, which is especially useful to con-

tractors and others when it is necessary to handle quickly and economically large quantities of muddy or dirty water. The diaphragm is $12\frac{1}{2}$ inches in diameter and is made of the best quality of rubber with rubber-faced metal valves which are easily renewable. The waterways are large and practically unchokable.

This pump comes with either side or bottom suction, but the stock pumps are made only with side suction. These outfits are furnished with either a 1 or a $1\frac{1}{2}$ -h.p., 4-cycle engine with hit-and-miss governor and cooling hopper of reliable and simple operation. The gears of the jacks are machine-cut from solid blanks in order to reduce friction and noise to a minimum. The pump and engine are mounted on substantial wood skids, making them readily portable. The outfit equipped with a 1-h.p. engine weighs 585 pounds.



A COMPACT, PORTABLE POWER DIAPHRAGM PUMPING OUTFIT

A Steam Shovel That is Always Ready for the Job

THE steam shovel has come to be the pioneer of real progress, the trail blazer of transportation, commerce and industry. The new Marion "21" manufactured by the Marion Steam Shovel Company, Marion, Ohio, has been developed to provide greater power, speed, capacity and endurance. Into the engine have been incorporated all of the improvements recognized in modern engine building. The 6-inch bore and 6-inch stroke, the liberal steam and exhaust ports, and the

by 8 feet high, large enough to insure ample steam volume and pressure at all times.

Good speed of operation is insured by the full boiler capacity and efficient engines, and with the improved three-lever control the operator's efficiency is materially increased, resulting in greater speed with less expenditure of effort and toil. The capacity of this machine, with its $\frac{3}{4}$ -yard shovel, is of course governed by working conditions and the nature of the material handled, but in the



A MARION MODEL-21 SHOVEL AT WORK ON ROUGH GROUND ON A ROAD JOB, KEEPING A LINE OF WAGONS HUSTLING TO GET THE SPOIL OUT OF THE WAY

double vertical hoisting engine are unusually large and powerful. In order to strengthen the shovel and to eliminate wearing parts, the usual link reverse has been eliminated and the new engines are reversed and controlled by a central valve contained within the throttle and operated by a single lever. The rotating and crowding engines are of the same rugged construction, with all parts of liberal size and readily accessible for inspection. The boiler for this power plant is 45 $\frac{3}{8}$ inches in diameter

hard, tough job, as well as the ordinary, easy one, this new shovel will give maximum capacity at low cost.

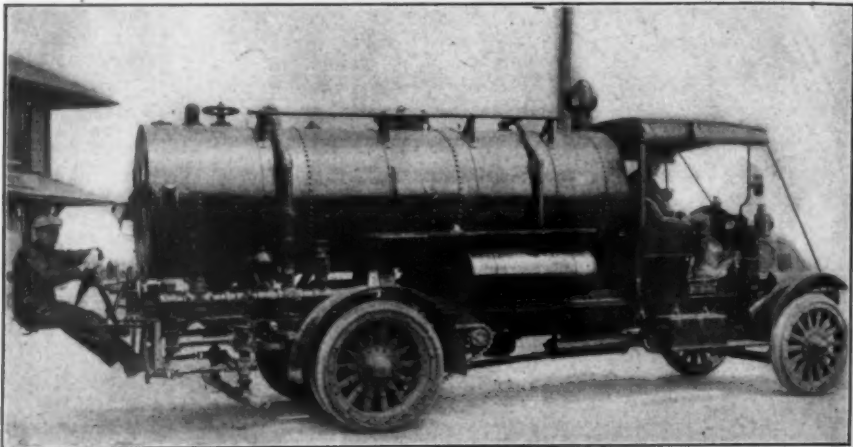
The shovel was particularly designed for road and street grading where the shovel must move right along and get out of the way to permit speedy operation of the equipment to follow. In basement excavation, sewer and trench work and sand and gravel plants, it has already demonstrated its value as a time and labor saver.

Applying Bituminous Material for Road Maintenance

IN the treatment of roads and highways with bituminous material it is well known that the proper application of such materials is of as much importance as the quality or nature of the material itself. Good material has been injured or condemned and time and money wasted because of the use of crude methods of application and the use of inferior apparatus with consequent unsatisfactory results. The Kinney Manufacturing Company, 3529 Washington Street, Boston, Mass., manufactures an efficient combination auto heater and distributor for heating and applying under pressure all

ing it with the steel frame of the truck and by means of falls lift the entire oiling outfit as one unit from the truck chassis. The time required for demounting need not exceed ½-hour and is accomplished without detaching any parts disconnecting any piping or in any way disturbing the adjustment of the tank equipment. By this arrangement the truck becomes a permanent all-the-year-round investment, while the distributor is available during the entire season when it is needed.

The tank of the distributor is fitted with horizontal tubes and equipped with kerosene



A KINNEY DISTRIBUTOR MOUNTED ON A KELLY-SPRINGFIELD TRUCK FOR SPREADING BITUMINOUS MATERIALS ON ROAD SURFACES

kinds of bituminous materials, either hot or cold, for road construction, maintenance or dust laying. The amount of heat and volume of material applied are under constant control of the operator, and positive pressure is produced at all times within the tank by the Kinney pump. One of the particular features of this distributor is that it can be demounted from the truck chassis in order that the truck itself may be available for other purposes when not required for road oiling. The tank is mounted upon a separate sub-frame so that it is only necessary to remove the bolts connect-

oil burners so arranged as to convey the hot gases through the tubes, giving high heating efficiency. The pump is of the rotating plunger type, of sufficient capacity to give a uniform pressure at the nozzles. The nozzles are adapted to produce a uniform spray in any desired volume and are so made that with proper care they will not become clogged through accumulation or hardening of material. All valves and controlling levers are so arranged that they may be manipulated by the operator from his seat at the rear of the apparatus.

Valuable Publication—"Dredging Engineering"

PROBABLY the first comprehensive treatise covering every phase of the subject of dredging has just been published by the McGraw-Hill Book Company. The author, F. Lester Simon, has prepared a book dealing with the construction and operation of the principal types of dredges, which are described

in detail. The second part of the book deals with the actual planning and working-out of dredging problems. This instructive publication may be secured from the CONTRACTORS' & ENGINEERS' PURCHASING GUIDE for \$2.50, or in combination with a year's subscription will be sent for \$3, postage prepaid.

A Power Wheel Bucket for Small Portable Cranes

ALIGHT, substantial and very efficient clam-shell bucket of the "bull-wheel" type, especially desirable for use on small portable cranes, has been developed by the Blaw-Knox Company, Pittsburgh, Pa. In ordinary buckets of this type the "bull-wheel" is mounted on the main hinge pin, in which position it rests on the material when the scoops are wide open, holding the bucket off the pile, and when partially closed, seriously interfering with the picking up of a reasonably sized load. These defects are overcome in the Blaw power-wheel bucket by mounting the wheel on a shaft of its own above the main hinge. This arrangement keeps the wheel well out of the material being handled, enables the bucket to open wider than is commonly possi-



LOADING ROAD MATERIAL



LOADING TRUCKS FROM GRAVEL BANK

equally strained.

The head is made of a single annealed open hearth steel casting, riveted to one pair of corner bars to secure rigidity. The other pair of corner bars is pinned to the main head pin, which turns in bushed bearings in the head casting. The head also supports a pin on which two sheaves are mounted: one is used either to turn a two-part holding line or as an anchorage thimble when a single holding line is used, the other sheave and the roller on the upper corner bar pin guide the closing line into the bucket. This general arrangement permits the bucket to open out to a very wide angle and to close with more of a shovel action than a scraping action, throughout the greater part of the closing stroke. The shape of the scoop enables

ble in buckets of this kind, and permits the use of a larger power wheel. As the bucket closes, the wheel revolves under the head and over to one side, thus saving headroom. The shaft upon which the power wheel turns is rigidly pinned to the hinge castings of one scoop. The rim of the wheel is surrounded by a substantial guard which is riveted to the same hinge casting. Wire rope cable doubled, wrapping in a helix around the hub of the power wheel, is used for the two power ropes. The loops of the doubled ropes go through cored holes in the short steel shaft turning in a lubricated bearing in the power wheel. The top ends of the power ropes are securely anchored to an equalizer bar suspended from the main head pin. The power ropes are by this arrangement always



EXCAVATING IN A TRENCH

this bucket to utilize its weight to the best advantage in gathering up a load. The line leads are good, the bucket hanging level, either open or closed, although the power wheel is not on the center line. The weight of the bucket is as little as will suffice to secure ample strength for steady service, but quite sufficient

to cause the bucket to gather up the load specified. This bucket may be equipped with cast steel, chisel-shaped teeth to be bolted to the lips when desired. Teeth are useful in digging clay or soil, but are not necessary and should not be used when the bucket is handling coal, sand, gravel or similar bulk materials.

Relations Between Engineers and Contractors

By Ben Johnson

Former President, Florida Engineering Society

IN drawing up contracts to do a certain piece of engineering work, the engineer makes himself the arbiter of the contractor's destiny by such paragraphs as: "In case of dispute, the engineer's decision shall be final, etc." All engineers put these in contracts. It is a custom that has come down to us from our predecessors of many ages. Now, I am not going to criticize these paragraphs as such. I do not presume to say that they should not be inserted. I do feel that they are sometimes too arbitrary, and I know that this power put into the hands of an unscrupulous or prejudiced engineer can go far towards financially embarrassing an honest contractor. I refer to them because I should like engineers and the public generally to know the contractor's side.

We may state as a premise that the contractor undertakes to perform a piece of engineering work for the purpose—and in general the sole purpose—of making a profit out of it. I will go further and say that it is practically impossible for a piece of work to be done exactly according to all the requirements of the specifications. All human efforts are an approximation of the perfect, and we approach perfection of accomplishment in direct proportion to our ability and honesty. These being accepted facts, the engineer must take certain compromises with conditions, and he is justified in this so far as the work will render to the party represented by the engineer as good service in all respects as though done perfectly. Whenever the engineer holds a contractor more to the letter than to the spirit of the contract, the above paragraphs are obnoxious, and the contractor under some circumstances becomes a loser.

No engineer has a right to ask a con-

tractor to sign a contract with the engineer specifically named as the sole arbiter unless the engineer at the same time binds himself morally to protect the contractor within his rights. I believe the engineer, although paid by one of the parties to a contract, is in reality an umpire for both equally. In contracts of any magnitude, unforeseen circumstances always arise which place the contractor at the mercy of the engineer, and it is the engineer's honorable duty to see that justice is done to both parties.

One of the usual clauses in a contract is: "While these plans and surveys have been prepared with care, the nature of material and borings is not guaranteed." Did you ever consider what this clause might reasonably be interpreted to mean—that the contractor should do all the engineer's investigation over again at great expense, and then not be the lowest bidder? No contractor can make a practice of this, and he must accept the work as accurate and as describing the conditions faithfully. The engineer again places himself in the position of final judge, and is therefore again required by justice to protect the contractor, even though the party whom he represents is the loser, for the contractor of necessity takes the work upon faith in the fairness of the investigation of the conditions, and in the truthfulness of statements of the specifications.

Did you ever think of the many laws, many volumes of statutes in the different states of the United States upon the subject of contract work, and that all, or practically all, are for the protection of the owner, the material man, the laborer, but make practically no provision for the protection of the contractor? The more

reason why the engineer has the double responsibility of seeing to the interests of both parties.

In works of an engineering character, such as roads, bridges, canals, harbors, etc., there can be no certain knowledge of the conditions except as the work progresses, and the man who undertakes this kind of work gambles with fate, hoping that he will get an even break with the party of the first part.

You never saw a contractor sidestep a cost-plus job, did you? Yet I tell you frankly that a legitimate contractor never figures his profit so low as the per cent he is willing to take. Why? Because he is

uncertain as to conditions.

I believe it is incumbent upon the engineer to describe all the conditions surrounding a piece of work fairly and truthfully, both pro and con, so that the contractor may receive a fair compensation and minimize his chances of loss. The engineer who makes a practice of complete frankness will gain a reputation with contractors that will put him in a position to serve his clients far better, both as to prices and quality of work, than the engineer who gets the reputation (and there are many) of being mean.

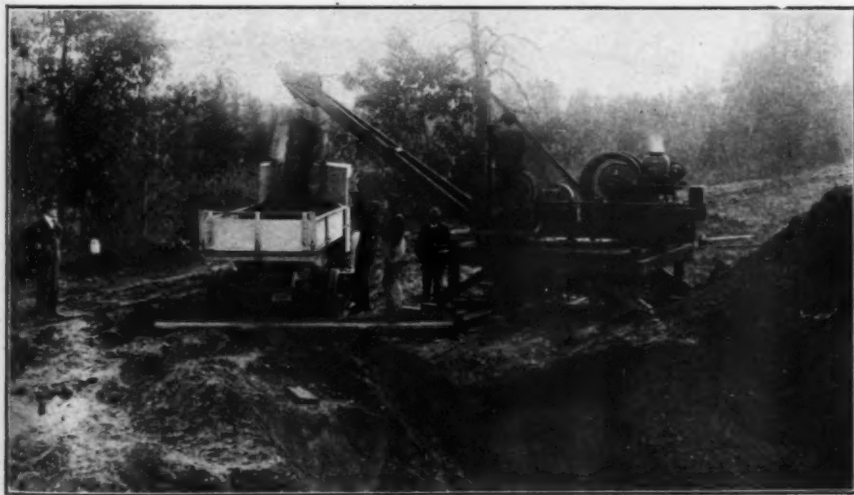
ACKNOWLEDGMENT:—From a paper delivered before the Florida Engineering Society.

The Motor Truck in Heavy Hauling

In April, 1918, C. H. Whittenberg, a road contractor and builder of Hartland, Wis., purchased a 3½-ton Kissel heavy-duty truck, equipped with dump body and hydraulic hoist. He used this truck continually on highway road work, hauling stone, screenings and gravel continuously every working day, up to January, 1919. During the winter the truck was laid up because of bad weather which made the roads impassable, but as soon as the roads were usable again, Mr. Whittenberg began operations, and the truck was in continuous use during the entire year of 1919 on Waukesha County highway work. The truck averaged 1,100 miles per month, carrying 4 cubic

yards of stone, weighing about 10,000 pounds.

In addition to this 3½-ton Kissel truck, Mr. Whittenberg has two 5-ton trucks of another make on the job, and a careful check showed that his Kissel was hauling equal loads, bucket for bucket, with the other trucks, proving the substantial qualities of the Kissel truck and showing its loading capacity was equal to that of the 5-ton trucks at a less initial cost. The accompanying illustration shows Mr. Whittenberg's loading equipment placed on the edge of one of the pits, so that it is unnecessary for the truck to go down into the pit, thus saving much time and enabling the truck to make a quicker getaway.



LOADING THE 3½-TON TRUCK AT THE GRAVEL PIT

Live Contractors Rely on Powerful Motor Trucks and Machinery



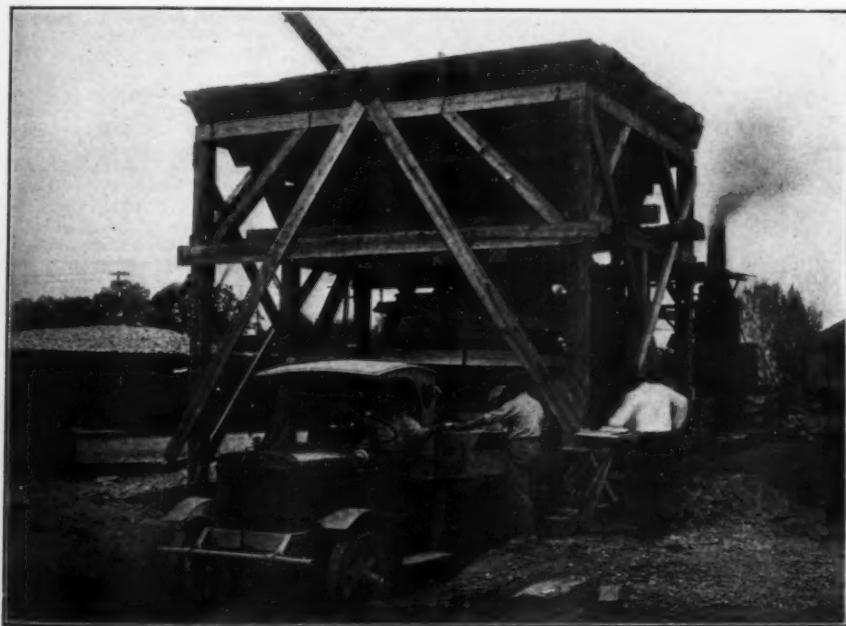
PART OF THOMAS, BENNETT & HUNTER'S FLEET OF WHITE TRUCKS AT WORK IN CARROLL COUNTY, MD.



A NOVEL HAULING JOB—A U. S. MOTOR TRUCK MOVING A ONE-STORY BUILDING TO A NEW LOCATION



A 5-TON ACME, OWNED BY S. J. PETERSON, CONTRACTOR, EXCAVATING AT MINNEAPOLIS, MINN.



A SERVICE 5-TON TRUCK HAULING CRUSHED STONE FROM BIN ON AN ILLINOIS ROAD JOB

Building Mississippi's Roads

ONE of the leading road contractors in the Delta country of Mississippi is S. K. Jones, of Frair's Point, Miss., Memphis, Tenn., and Little Rock, Ark. Mr. Jones has, during the past year and a half, handled the biggest contracts let in Coahoma, Quitman and Franklin Counties, Miss., and is rapidly enlarging the scope of his operations. During the past year he built 75 miles of gravel roads in Coahoma County, Miss., with a crew of some two hundred men and seven trucks, including four U. S. trucks among them.

The average haul from cars to road work has been from two to three miles. The trucks, manufactured by the U. S. Motor Truck Company, which are loaded with a Byers Auto-Crane, are averaging 100 miles per day, making from twenty to twenty-five trips, and averaging 8 miles to the gallon on gasoline. All the trucks are fitted with U. S. steel bodies, having automatic tail gate release and spreading device, and each saves the work of four men in spreading gravel on the roads.

According to Mr. Jones' carefully kept fig-



LOADING GRAVEL UNDER THE HOPPER ALONGSIDE THE CARS

ures, each truck has done the work of eight teams and at one-fourth the cost. His figures further show the economy of U. S. trucks over the others used, in that his U. S. equipment has given twice the mileage of the others at one-half the operating cost.

After the hardest kind of service last summer and fall, over new roads, no roads, fresh

fills, etc., the U. S. equipment was overhauled in January of this year, and the average cost per truck for inspection, parts and labor was \$48.39 per truck. Under the working condition, this is a remarkably low overhauling expense.

The owner, an experienced contractor, who takes good care of his trucks and who has been building roads for years with trucks of all kinds, mules and horses, etc., is thoroughly convinced of the efficiency of motor trucks for heavy road contracting.

The views herewith reproduced give a good idea of the service rendered by the trucks used on this job. When the crane cannot load the trucks directly, it is used to fill the temporary wooden hopper alongside the gondola cars. Trucks are run under the hopper and are loaded very speedily, thereby greatly reducing the time which the trucks are idle. Such methods are being generally used by contractors.



STARTING AWAY FROM THE CARS WITH A CAPACITY LOAD OF GRAVEL

CATALOGS FOR

The catalogs and pamphlets listed below are available for free distribution. Contractors and Engineers who check over these pages each month and write for such material as interests them, will find this a valuable means of keeping up to date on the subject of machinery and equipment.

CONTRACTORS

FREE HANDBOOK ON ROAD BUILDING.

The National Steel Fabric Co., 909 First National Bank Bldg., Pittsburgh, Pa., has issued a valuable handbook for designers and builders of concrete highways, containing specifications, tables, etc., of daily use to engineers and contractors, gathered from active authorities on road building.

"CONCERNING ONE-TON LOADS."

A folder bearing this title has recently been issued by the Lee Trailer and Body Co., 2343 South La-Salle St., Chicago, Ill., containing valuable data on the handling of the dry aggregate of concrete paving work, both by the single-batch and multiple-batch methods, making use of the well-known Lee Line bodies. Contractors securing a copy of this folder will find much of value therein.

"SCIENTIFIC SHOVELING."

In an attractive and interesting booklet entitled "Scientific Shoveling," the Wyoming Shovel Works, Wyoming, Pa., gives information from various sources on the uses and types of shovels for various kinds of work.

A TANK FOR EVERY PURPOSE.

Bulletin 114 G, issued by the Heil Co., Milwaukee, Wis., describes the uses of Heil compartment tanks, which are used extensively throughout this country for the transportation of different kinds and types of liquids. The Heil Co. also makes steel dump truck bodies and hoists for dumping trucks.

MIXERS—HOISTS—WHEELBARROWS.

A 48-page catalog describing Lansing concrete mixers and other equipment, such as hoists, mortar mixers and wheelbarrows, may be secured by writing to the Lansing Co., Lansing, Mich.

CARBIDE LIGHTS FOR NIGHT WORK.

Standard, reliable, economical and efficient carbide lights for illuminating night work are described in the bulletins of the Alexander Milburn Co., Baltimore, Md.

BARGAINS IN CONTRACTORS' EQUIPMENT.

Modern rebuilt equipment for prompt shipment to contractors is listed in the bulletins of the Contractors' Machinery & Supply Co., 509-11-14 Wabash Building, Pittsburgh, Pa. These bulletins may mean money in your pocket and quicker delivery, and, with this company's guarantee, will help you materially. These people also rent, lease and give terms to contractors.

PILE HAMMERS AND HAMMER DRILLS.

Labor-saving equipment in the shape of double-acting pile drivers and rotating hammer drills are described in Bulletins 25 and 26, respectively, issued by the McKiernan-Terry Drill Co., 15 Park Row, New York City.

DETAILS OF CONCRETE MIXERS.

Bulletin 104, published by Ransome Concrete Machine Co., 1772 Second St., Dunellen, N. J., describes in detail the features of Ransome concrete mixers for road building and concrete construction, and lists the claims of the manufacturer for their mechanical superiority.

TRAILERS INCREASE CONTRACTORS' PROFITS

The new Troy Trailer catalog, published by the Troy Wagon Works Co., Troy, Ohio, describes in detail the newest models of Troy trailers with different types of bodies built specially for contractors.

LOCOMOTIVES FOR HIGHWAY WORK.

The Fate-Root-Heath Co., Plymouth, Ohio, manufacturer of industrial gasoline locomotives is issuing a 24-page special road bulletin emphasizing the use of locomotives in improved highway construction. It features installations showing illustrations of the locomotive in actual use in various states under varied conditions.

TRENCHING MACHINES.

The Austin Machinery Corp., Railway Exchange Bldg., Chicago, Ill., tells in Catalog A-118 all of the features of its trenching machines which are the result of on-the-job experience.

STANDARD EQUIPMENT FOR CONTRACTORS.

Catalog No. 69, issued by the Standard Scale and Supply Co., 1631 Liberty Ave., Pittsburgh, Pa., gives complete listings of "The Standard" line of contractors' equipment, including concrete mixers, street pavers, hoists, pumps, gas, gasoline and oil engines, material elevators, wheelbarrows, etc.

ELEVATING AND CONVEYING MACHINERY.

The Weller Mfg. Co., Chicago, Ill., manufacturer of elevating, conveying and power machinery for cement mills, stone and ore-crushing plants, coal-handling systems, sand and gravel washeries, fertilizer and phosphate mills, grain elevators and flour mills, brickyards, etc., has published its catalog No. 30-G, a complete list and description of its products.

A PORTABLE WOODWORKER.

A portable woodworker with all the necessary attachments for molding, mortising, tool-grinding, etc., and equipped with a "Z" engine, is described in catalog J-705-A, which may be secured from the Contractors' Equipment Department, Fairbanks, Morse & Co., 30 Church Street, New York City.

LOCOMOTIVES CRANES.

The McMyler Interstate Co., Cleveland, Ohio, in bulletin No. 39, describes the many uses of its locomotive cranes in the contracting field. This bulletin and the smaller bulletins of this company describing clam-shell and orange-peel buckets are of particular value to contractors.

YOU NEED A BACKFILLER.

Backfillers of both the traction and non-traction type manufactured by the Waterloo Construction Machinery Co., Waterloo, Iowa, are described in a booklet entitled "Old Indispensable."

BUILDING ROADS WITH LESS LABOR.

A valuable booklet for contractors, entitled "Road Building with Less Labor," has been prepared by the Engineering Department, Service Motor Truck Co., Wabash, Ind., and may be secured by writing to C. C. Frame, Transportation Engineer.

STEEL FORMS FOR ROAD CONSTRUCTION.

Heltzel steel forms for the construction of roads, pavements, highways, curbs, combined curbs and gutters, etc., are described in an interesting series of illustrated bulletins, which may be secured from the Heltzel Steel Form and Iron Co., Warren, Ohio.

TEAM WORK IN LOADING MACHINES.

An illustrated folder showing the work of B-G loaders and conveyors, with valuable data showing the rate of loading and capacities, may be secured by writing to the Barber-Greene Co., Aurora, Ill., and asking for catalog and complete information on B-G standardized material-handling machines.

INDUSTRIAL RAILWAY CARS AND LOCOMOTIVES.

In General Catalog No. 1 the Koppel Car and Equipment Co., Koppel, Pa., gives a complete listing of the well-known line of Koppel products, including portable railways, industrial railways, narrow-gauge siding and electric-driven cars, trucks and locomotives.

PERMANENT TYPE OF CONCRETE PIPE.

The lasting qualities of Lock Joint reinforced concrete pressure pipe and standard culvert and sewer pipe from 12 inches to 48 inches in diameter are described in literature which may be secured from the Lock Joint Pipe Company, 1123 Broadway, New York City.

MOTOR TRUCKS WITH REPEAT ORDERS.

One of the great claims of the White Company, Cleveland, Ohio, for its motor trucks is the ever-increasing number of repeat orders. These trucks are described in detail in a contractors' bulletin which may be secured from this company for the asking.

"A PERFECT TRENCH AT ONE CUT."

This is the claim of the Buckeye Traction Ditcher Co., Findlay, Ohio, for its trench and pipe-line excavators, which are described in an interesting booklet, "A Patriot of Iron—Delves for Independence," which may be secured by writing to D. L. Royce, of the Buckeye Co.

SAVE STEEL IN REINFORCING.

An effective method of increasing the bonding value of reinforcing bars is described in literature which may be secured from the Corrugated Bar Co., Inc., Buffalo, N. Y., manufacturers of standard sizes of corrugated bars which have definite bonding values.

REINFORCING FABRIC FOR CONCRETE WORK.

In a well-illustrated 112-page pamphlet entitled "Truscon Building Products" the Truscon Steel Co., Youngstown, Ohio, describes in detail its trussed bars, column reinforcing, metal lathe and reinforcing for concrete sewers, as well as many other materials.

A LITTLE GIANT FOR WORK.

An interesting descriptive catalog giving the details of construction and operation of the "Little Giant Road Crane" may be secured by writing to the Locomotive Crane Co. of America, Champaign, Ill.

ROAD BUILDING AND MAINTENANCE.

Complete illustrated and descriptive catalog of motor-driven heaters and distributors for heating and spraying all varieties of material for bituminous road treatment, and unloading and transfer pumps and storage tanks for tar and asphalt, may be secured by writing to the Kinney Mfg. Co., 3529 Washington St., Boston, Mass.

ALL-STEEL EXCAVATORS.

The advantages of the Model 4 Keystone all-steel excavator with skimmer or boom extension with 1/2-yard clam-shell bucket are made very obvious to the contractor, in literature which may be secured on request from the Keystone Driller Co., Beaver Falls, Pa.

COMPRESSED AIR ROCK DRILLS.

If there is anything you want to know about rock drills, either tripod or column mounted for tunneling, toe holing, or wherever deep holes in hard rock are required, write to Ingersoll-Rand Co., 11 Broadway, New York City, and ask for this company's descriptive circular telling about I-R No. 248 rock drills.

INDUSTRIAL CARS FOR CONTRACTORS.

Catalog No. 8, which may be secured from Henry N. Bell, of the Biehle Iron Works, Inc., Reading, Pa., contains illustrated descriptions of standard and special side-dump cars for contractors, on which this company can make very early delivery and which are especially suited for rapid work.

AN EXCAVATOR CRANE OF DIVERSIFIED USES.

An excavator crane combining the advantages of the locomotive crane, traction tread, gasoline operation, interchangeability of buckets and devices, is described in a flyer entitled "The Industrial Handy Man," issued by Pawling & Harnischfeger Company, Milwaukee, Wis.

A MANY SERVICE GAS ENGINE.

The "New-Way" Motor Company, Lansing, Mich., has developed a 5-horse-power, air-cooled, multi-purpose gas engine for use with gasoline or kerosene, which appeals particularly to contractors for operating pumps, tampers, etc. Literature on this engine may be secured on request by asking for a copy of bulletin C-20.

A POWERFUL MOTOR TRUCK

If you are interested in securing for your work motor trucks which have a recognized standing and reputation, get in touch with the International Motor Co., New York, N. Y., and ask for a copy of catalogs 13 and 30, containing detailed descriptions of the many exclusive features of this truck.

CONTRACTORS' HEAVY-DUTY TRAILERS.

Arcadia drop-frame trailers, built to stand the strain and to clear the load when dumped, are described in a bulletin which may be secured from the Arcadia Trailer Corp., Newark, N. Y.

TRACKLAYING TRACTORS FOR CONTRACTING.

In a well-written booklet, "Why Best Tractors Are Tracklayers," the C. L. Best Gas Traction Co., San Leandro, Calif., outlines the real fundamental principles of tracklaying tractors, and brings out points of great value to contractors regarding the use of tractors.

GRAVITY CONVEYORS FOR LUMBER, CEMENT AND BRICK.

In its major catalogs, the Mathews Gravity Carrier Co., Ellwood City, Pa., describes the use of its gravity carriers for handling lumber, bricks and cement. In Bulletin 3 this company delivers a special message to building contractors, paving contractors, jobbers and dealers in building supplies.

LOCOMOTIVE CRANES OF ALL TYPES.

Full-revolving, gasoline-operated locomotive cranes with crawler type wheels, round traction wheels or standard railroad wheels are manufactured by the Northwest Engineering Works, Chicago, Ill. Full information and data may be secured by writing to this company and asking for a copy of its latest illustrated catalog.

MAKING CONCRETE MORE WORKABLE.

If you are interested in the preparation of better concrete floors with a superior finish, write to The Master Builders Company, Cleveland, Ohio, and ask for full information regarding Master Mix, a liquid which controls concrete and produces a finer finish.

EQUIPMENT BUILT TO YOUR NEEDS.

The Knickerbocker Company, Jackson, Mich., manufactures concrete mixers, single and double drum hoists, force and diaphragm pumps, and other machines for contractors' work. Catalog describing any or all of these machines may be secured for the asking.

REDUCING MOTOR TRUCK MAINTENANCE.

One of the chief means of reducing motor truck maintenance is to start with the right kind of truck. The Packard Motor Car Company, Detroit, Mich., has issued special bulletins for contractors, showing the particular advantages of the Packard truck and the Packard service stations throughout the country, which will help reduce maintenance charges.

STANDARD HOISTING ENGINES, CABLEWAYS, DERRICKS, ETC.

In the sixth edition of "Improved Hoisting Equipment" the National Hoisting Engine Company, Harrison, N. J., illustrates and describes in detail its various types of steam hoisting engines, electric hoists, gas and gasoline engine hoists, belt-operated hoists, derricks and derrick fittings, trench cableways and pile drivers.

FREE BOOK ON ROAD BUILDING.

A very complete book, especially valuable to contractors and engineers, containing particular reference to reinforcing for concrete roads, may be secured by writing to the American Steel & Wire Co., Chicago, Ill.

CONSTRUCTING BRICK AND OTHER BLOCK ROADS.

A free pamphlet, containing complete instructions and describing the methods of applying paving pitch, particularly Tarriva MF for brick, wood block and granite block pavement, may be secured by writing to Philip P. Sharples, Manager, General Tarriva Department, The Barrett Co., 17 Battery Pl., New York City.

INSTALLING EXPANSION JOINTS IN ROADS.

An interesting bulletin for the contractor, showing how the permanence of concrete streets may be insured by the use of Elastite, an integral expansion joint which eliminates buckling and expansion cracks in concrete, block and granite pavements. May be secured from the Philip Carey Co., 6 Wayne Ave., Lockland, Cincinnati, Ohio.

Revolving Shovel Operation at the White Company's Plant, Cleveland

A $\frac{7}{8}$ -Yard Shovel Averaged 1,042 Yards a Day, Loading Motor Trucks with an Average of a Little Over 128 Cubic Yards per Hour, Actual Operating Time

THE Fred R. Jones Company, of Chicago, one of the many well-known railroad contractors who early foresaw the impending stagnation in railroad construction and wisely shaped their course accordingly, has recently completed an interesting job in Cleveland, Ohio.

Description of Contract

The contract called for the excavation work in connection with an extension of the White Company's plant. The excavation consisted of the digging of a basement, approximately 180 feet by 600 feet, with an average depth of $11\frac{1}{2}$ feet, a total yardage of about 31,000.

The contract was received on July 23, 1919. The shovel was loaded and shipped to Cleveland from Indianapolis, and actual digging was started August 1 and completed August 29. In 29 10-hour working days the shovel moved 30,119 cubic yards, the maximum daily output being 1,200 cubic yards. The exact time in which the shovel was actually in operation was 235 hours, making an average of a little over 128 cubic yards per hour in operation, or an actual daily output of 1,042 cubic yards, including all delays. The cost of loading, including installation charges and the cost of taking the shovel out, was 13 cents per cubic yard.

How Material Was Handled

The material was loaded into 5-ton White motor dump trucks, an average of 8 trucks being on duty. The average lift of the shovel was $18\frac{1}{2}$ feet. The material for the most part was sand and loam. It was wasted in the lake, with a haul of $\frac{3}{4}$ of a mile.

The shovel was delayed by the necessary moving up, waiting for trucks and for water, and on account of other work going on in the same lot simultaneously. This delay totaled 23 hours, including a day and a half lost on account of suspension of work, due to severe rain storms. Twelve hours were lost through trucks being blocked at a railroad crossing. F. E. Welsh, of the

Fred R. Jones Company, states that if it had been possible to keep trucks under the shovel they could have averaged 1,200 cubic yards per 10 hours.

The Shovel

The shovel was an 18-B Bucyrus mounted on caterpillar traction. It was equipped with a $\frac{7}{8}$ -cubic-yard dipper and a 28-foot boom and 20-foot dipper handle. This combination of boom and dipper handle was longer than the standard. It made it possible for the shovel to take this excavation in one cut and dump into trucks, an average lift of $18\frac{1}{2}$ feet. The caterpillars not only saved considerable time in moving up, but reduced the number of men ordinarily required in the pit.

In reference to the performance of this shovel, Mr. Welsh writes as follows:

"We had wonderful success with this machine in widening cuts on the L. A. & S. Railroad between Lorain and Ashland, Ohio, in 1917, on account of its long reach, also on the Eastern Division of the Pennsylvania Railroad near Indianapolis, Ind. We find this machine works fine on double, third and fourth tracking, on account of not having to take extra width out for jack arms and blocks, which class of work it has been used on principally.

"Please bear in mind that this shovel made this record in Cleveland, Ohio, after having been in continuous use on railroad work for over two years, and after completing the White job it handled two other small jobs in Cleveland, and is now working at Fairmont, W. Va., on street and industrial work and still performing wonderfully well. About the only repair we made after completing work in Cleveland was to rebuild the blocks on caterpillars, caused by movement over rough cobblestone streets."

What the Shovel Runner Says

The following, taken from a letter from C. C. Thatcher, the operator, is interesting not only because it is the experience of one who knows, but because it shows what can be done by a man who takes pride in the efficient performance of his job.

"Some think that I made a good record when I dug the basement for the White Auto Company at Cleveland in August, 1919. Yes,

it was fair, but not what can be done with the 18-B Bucyrus shovel. Some of the old-timers say, 'Take it out of her,' but I didn't take it all out of her because the weather was very hot and I have sympathy for the good old Bucyrus. But she finished the job of 30,110 cubic yards in 29 days. The actual working time was 235 hours, and there were practically no repairs except adjusting bearings and tightening up bolts. A few small bolts broke, which will happen to any shovel. I have been running this shovel two years and eight months, and most of the repair expense is for dipper teeth and cables. If I was going to buy a shovel I would look for the shovel that was hard on dipper teeth and cables. Outside of this, the only expense that is worth mentioning was a dipper hinge and a shipper shaft which was broken in very cold weather, when the iron was full of frost. I broke the shipper shaft by going through a pile of soft dirt and taking a header into an invisible filling with a wide-open throttle.

"The shovel has been up against lots of extremely hard work. I pulled frost with her three winters, rock and stumps in the winter of 1917, and I pulled 18 inches of frost and did but very little shooting. All that is actually worn out on this shovel, except teeth and cables, is one shipped pinion, which gets the most wear of anything on this shovel.

"The shovel is doing very satisfactory work for the Fred F. Ley Company at Fairmont, W. Va., and her advantage here is far ahead of most any other shovel, owing to her size and being mounted on caterpillars and having a special long boom and dipper arm. I am grading streets and digging cellars on a very steep hillside. Up and down a hill it goes, and in and out of the cellar, with very little trouble and very small expense. I have one pitman part of the time. When I am in mud and water I have two, but most of the time I have none. She is like a Ford. She never gets in a hole that she can't get out of.

"The picture that appears here is the 18-B coming out of the basement at Cleveland up a 17½ per cent grade on cribbing.

"I consider the Bucyrus revolving shovel the best on the market for durability and up-keep. The greatest thing of all is the yardage that they will put out. I will bet any man \$100 that I can take an 18-B shovel with a standard



THE BUCYRUS STEAM SHOVEL CRAWLING OUT OF EXCAVATION ON CRIBBING, 17½% GRADE

boom and dipper arm and with good conditions, with conveyances kept under the dipper, I can load 1,800 cubic yards in 10 hours.

"I wish to state also that the boiler in this shovel is in good condition. There has never been a boiler maker stuck his head in the fire door yet. She leaked after 14 months. I calked the tubes once, and she is as dry as a bone to-day. The boilers are built so they can be kept clean."

Organization of Job

The men employed on the job were: the foreman, the shovel operator and the fireman, two pitmen, a coalman, and two roadmen for trucks. Coal was delivered to the machine by trucks, and water was piped to the shovel.

ACKNOWLEDGMENT.—From an article in *The Excavating Engineer*.

Long Life and Low Maintenance

An area of 12,573 square yards of asphalt paving laid with Trinidad Lake asphalt was constructed in 1888—32 years ago—in Columbus, Ohio, on Bryden Road from Parsons Avenue to Twenty-second Street. This paving, which has handled the average traffic of city

streets throughout its life, has cost only 2.1 cents per square yard per year for maintenance. This record is excelled by eleven streets similarly paved 31 years ago in Washington, D. C., where the maintenance charges have amounted to only 1 cent per square yard annually.

Twenty-Seven Years of Rock Crushing Service

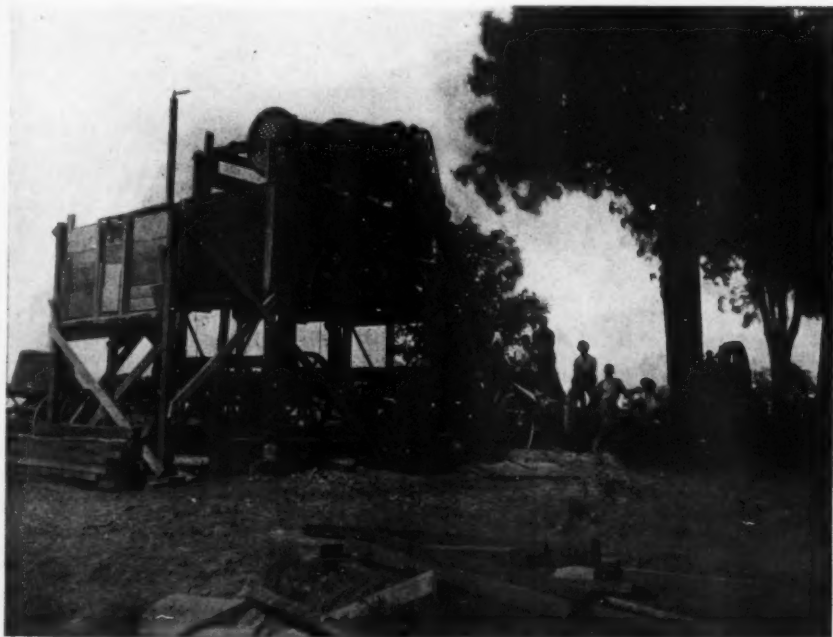
CRUSHED stone producers and quarrymen are particularly interested in securing satisfactory types of rock-crushing equipment, as well as elevating and screening machinery. The Good Roads Machinery Company, Inc., 836 Bulletin Building, Philadelphia, Pa., manufactures crushers in a wide range of sizes, from the small and comparatively light machines for portable use to the larger and heavier types for stationary plants. With these can be furnished all the appliances required for the installation of complete crushing outfits, including elevators, screens, conveyors, portable stone bins, steam or gasoline engine power, and rock drills.

Since the frame of a crusher is subjected almost entirely to a tensile or pulling strain, the frames of Champion crushers are made of high-grade rolled steel, which is the best material to withstand such usage. The frame is thoroughly bolted together in such a manner as to prevent any parts from working loose. Both the swinging and stationary jaws are of cast iron, which is the best material to withstand the severe compression strain to which these parts are subjected. The camshaft and anti-friction roller, toggle seats and all shafts

from which castings are suspended are of steel forgings, and the dies or crushing plate and toggles are special chilled castings.

The main shaft of this crusher is elliptical in shape so that one revolution of the fly-wheel produces two movements of the jaw, making it possible to secure the same results with the "Champion" as secured by other crushers, but with only one-half the speed. High speed means friction and heating the shafts and increasing wear and expense. The dies or crushing plates and toggles are made of special chilled castings to make them very hard and durable. They come in contact with the stone and are necessarily subject to wear. The cheek plates of high-grade steel are rectangular in shape and reversible in all four different positions, thus increasing their life through producing more uniform wear. One of the special features of the dies, which are made of chilled carbon iron, is that they can be reversed or changed in a few minutes and are planed to fit against the surface of the jaws, no zinc being necessary to secure a smooth surface back for them.

The No. 4½ crusher is a very popular machine. The receiving opening is 10 x 20 inches,



PLANT OF THE COLUMBIA CONTRACTING AND ENGINEERING COMPANY, WASHINGTON, PA. THIS PLANT CONSISTS OF A NO. 4½ CHAMPION CRUSHER, WITH MOUNTING, ELEVATOR, REVOLVING SCREEN, AND A PORTABLE STONE BIN



COMPLETE ROCK CRUSHING PLANTS SERVED BY RAILWAY

thus enabling it to take a large-size stone. It is convenient to operate and the feeding mouth is low, but it is not necessary to dig a hole for the bottom of the elevator to run in. The machine is of large capacity and has proved very durable in service.

The portable crushing outfit is particularly valuable for the contractor who expects to operate in a number of different localities during any one construction season. This crushing outfit can be moved without taking down either the elevator or the screen and can be operated just as it stands by blocking the wheels, which are made specially heavy and strong for that purpose. A better plan which affords a more solid foundation is to place two wooden sills under the I-beam sills, to which the crusher is attached. The rear end of the machine is then lowered by simply turning two screws with a straight iron rod, until the I-beam sills rest on the wooden sills. The front of the machine is then lowered by removing the front truck, the whole operation requiring very little time. When the crushing is finished and it is desired to move the machine, the operation is reversed and the plant is again on the road. The telescopic bin for use with this outfit is so arranged as to handle crushed stone in the easiest and most economical manner. The bin can be raised or lowered at will, and the same operation that controls the bin also raises the screen to the operating position or lowers it into the pocket of the bin when the outfit is to be moved on the road. The mechanism for raising and lowering the bin is so powerful that it can easily be operated by either one or both of the hand wheels, one of which is operated at the front and the other at the rear of the bin. By means of the worm gears by which

the power is transmitted the bin can be held in any position desired. The important result secured by lowering both the bin and the screen in one operation is to bring the center of gravity so low that the outfit can be moved on the road as readily as an ordinary wagon, thus obviating the danger of upsetting, which was frequently experienced in old-style, heavy-top bins. When the bin is in a position for moving on the road, the top of the bin proper is a little less than 8 feet from the ground. The supports or framework of the screen project about 2 feet above this point, so that the entire height for clearance is only 10 feet.

The strong wheels of the bin are located on the inside of the framework, thus allowing the carts or wagons to be brought close to the bin for convenience in loading. The front wheels cut under, making it possible to turn the outfit in a small space. When the bin is ready for work, the screen takes a position high enough above the bin to make it possible to fill the pockets readily with the crushed material. The regular bin has three compartments, and the bottom of the bin tapers in both directions and is lined with sheet steel, permitting the stone to flow freely into the wagons or carts.

No matter whether the crushed stone is to be used for metal or for ballast, the necessity for separating it into different sizes is apparent, and a crushing plant is rarely complete without a screen. "Champion" screens are made in 2-, 3- or 4-foot sections, according to special conditions, and are bolted and clamped together so that when it is necessary to renew a particular section it can be easily taken out and a new one put in its place. The screens are of rolled steel, made in 24-, 30- and 36-inch diameters and of any desired length.

EFFICIENT HIGHWAY MACHINERY

Kinney
QUALITY
EFFICIENCY



THE KINNEY HEATER AND DISTRIBUTOR

Road engineers appreciate the vital importance of using modern methods and apparatus in treating highways with hot or cold bituminous material. KINNEY Highway Machines are scientifically designed and constructed to handle all kinds of bituminous road material with the greatest economy and efficiency.

Guaranteed to sufficiently heat and properly apply any and all varieties of asphaltic or tar products now in use for bituminous treatment of ROADS AND HIGHWAYS.

Road Builders, Contractors, Municipalities and many others are saving time, labor and money by using KINNEY equipment.

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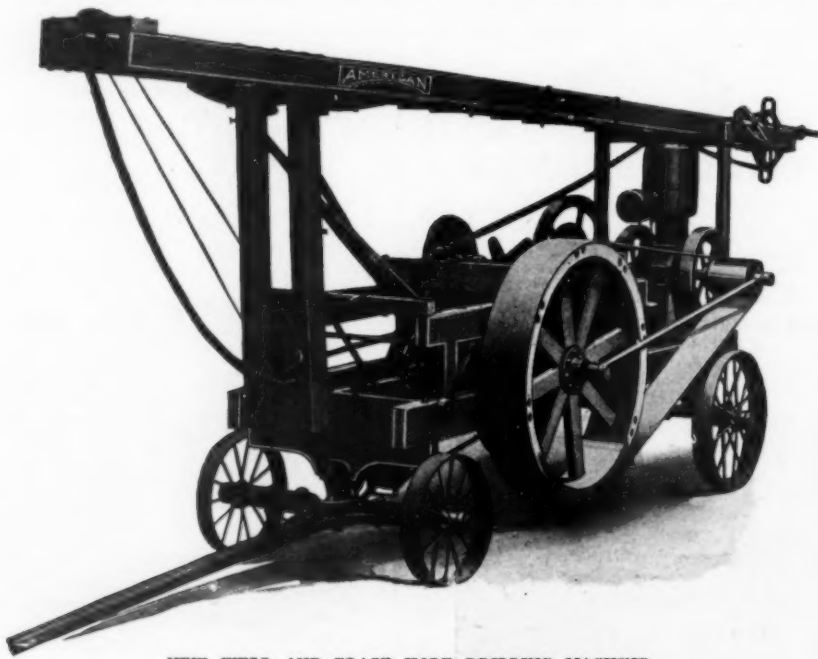
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A New Blasting Hole Drilling Machine for Quarrying

THE rapid development of gasoline and kerosene engines during the last few years has made these the most desirable forms of motive power for deep blast hole machines, so that the American Well Works, Aurora, Ill., is specializing in blast hole drillers equipped with internal combustion engines.

The "New American" gearless blast hole drilling machine which this company has developed is built close to the ground and is so balanced that it permits short turning and transporting over ordinary roads. It is constructed with ample strength of frame to carry the working parts of the machine in proper alignment, when operating heavy strings of tools at the high speed required in present methods of quarry blast hole drilling. It is claimed that this machine will jump tools smoothly at 60 strokes a minute, handling with ease a 4-inch diameter by 20-foot length drill bar, bit and socket, weighing from 1,100 to 1,200 pounds, and drilling a hole $5\frac{3}{8}$ to 6 inches in diameter. The spudding-beam is attached to the crank in such a manner that it gives a quick drop and hard stroke of the drill at a speed of 55 to 60 strokes per minute without any whipping of the drill cable, which is so annoying to the operator and destructive

to the cable. The drilling motion is imparted by the spudding beam carrying the spudding sheave. This is driven directly by the crank, which is keyed to the crank shaft. The spudding beam is of very heavy construction, which adds to its durability and also enables it to serve as a counterweight to the tools and effects a saving in power. No cog wheels or clutches are used on this machine. The spudding motion is stopped instantly with one lever when desired, regardless of the speed of the engine, and at the same time the hoisting drum may be started with another lever. When the spudding beam is stopped, the drilling tools are always hung up off the bottom, and they always start on the down-stroke when the beam is released. This obviates a heavy load on the engine when the tools are put in motion. The cable and sand reels are driven by friction. One lever operates the hoist, brake and feed-out, and one lever the sand reel hoist and brake. The absence of gears eliminates a source of frequent delay and expense in most blast hole drilling machines. The absence of the friction clutch does away with another source of annoyance and frequent trouble. This class of work is not adapted for friction clutches, and some of the best manu-



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facturers of friction clutches in the country do not recommend their clutches for satisfactory service on drilling machines of this type.

The power provided is a 10-horse-power, "Novo," hopper-cooled, frost-proof gasoline or kerosene engine, with full equipment, including speed regulating device, which is operated from the drilling end of the machine by telegraph cord. The derrick is of the rigid ladder type and has heavy braces run up to the crown sheave bearing. The crown sheave runs in a

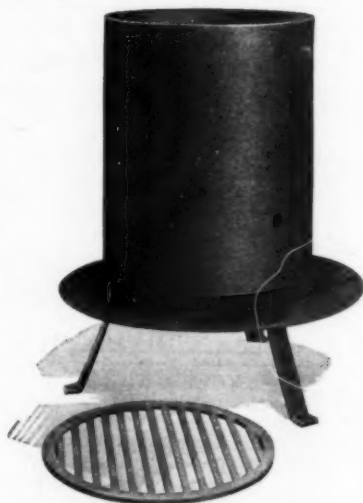
maple bearing, which is more durable than metal and is provided with a pocket for grease, enabling it to run several weeks without attention. An adjustable tool guide is furnished, fitted in the center of the derrick, also a ground guide for steadying the tools in starting a hole. The derrick is easily raised or lowered by hand, using a small hand winch on the machine. The machine can also be moved from hole to hole without horses by the use of the hand winch.

Salamanders a Paying Investment

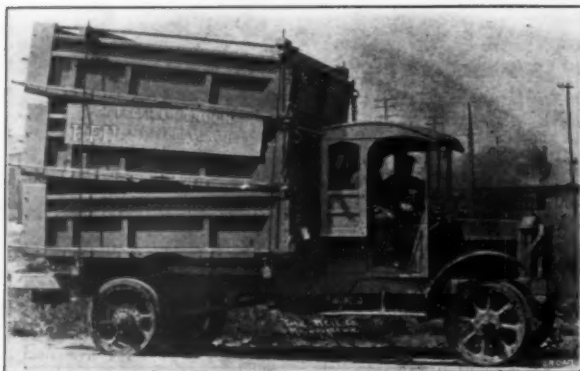
With the coming of cold weather, building operations usually suffer. To make them more comfortable and efficient, liberal use of salamanders about the building will be found a paying investment.

Littleford Brothers, 500 E. Pearl Street, Cincinnati, Ohio, have placed on the market a substantial, low-priced salamander which is made heavy enough to withstand the intense heat which it produces. Most satisfactory results are obtained when using coke, but other fuel can also be used. Because of the large ash pan and the height above the floor, these salamanders can be used inside of buildings for moderating the temperature and for drying plaster. They also keep concrete from freezing.

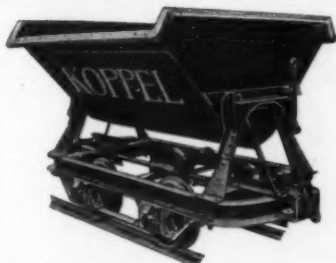
Winter concreting for outside structures, such as bridges, is not uncommon to-day. In many instances complete concrete bridges have been built during very cold weather, using large canvas coverings to completely envelop the structure, and maintaining sufficient temperature by means of salamanders, or by steam heating plants where the size of the structure necessitates using too great a number of salamanders.



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	Cents per Square Yard
Philadelphia, Pa., contractor.....	63
Brooklyn, N. Y., contractor.....	67
San Francisco, Calif., municipal plant.....	35
Brooklyn, N. Y., municipal plant.....	49
Washington, D. C., contractor.....	66
St. Paul, Minn., municipal plant.....	40
New Orleans, La., municipal plant.....	46
Louisville, Ky., municipal plant.....	46

Work done in other cities has shown satisfactory results no matter whether the work has been done by contract or by municipal forces. Prices have been moderate and the work satisfactory.

The Gospel of Work

Is America to become a nation of shirks and slackers? Shall we continue to "let George do it"? Or are we now ready to emerge from the mental slump which followed the great war and jump aggressively into the world-wide battle of commerce, forcing our way to our rightful leadership among the nations of the earth?

Our place is among the leaders of the earth in commerce, finance and industry, but unless we come out of our trance that place will be forever lost to us. America to-day plays the part of the dissolute Nero, jazzing away the precious hours while the Rome of our opportunity is destroyed by the fires of indifference. "George"—meaning both our friends and our enemies among the nations—is doing it, all right. He is going full speed ahead. Instead of leading, we are trailing. And lack of production is wholly responsible.

Production means work—work—and still

more work!—until each of us has reached the height of his efficiency and earning power. Not alone do we need production in the factory, but in the office, on the road, on the farm, in the home—in every phase of our lives.

Work, for the joy of the work itself; for the sake of successful accomplishment; for the betterment of all; to bring down the high cost of living through increased production and decreased overhead; for the future peace and comfort of our sons and daughters; for the salvation of America—**work!**

Talk will not right conditions. Act! Work more and talk less. And as production creeps higher, day by day, the difference in prices and conditions will become apparent. Production alone will make that difference. Work brings production. Preach the Gospel of Work.

—An editorial by H. H. Southgate from The U. S. Floating Power Plant News.

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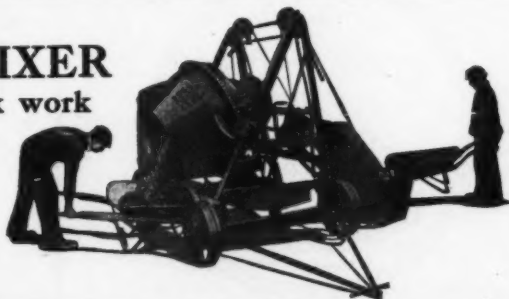
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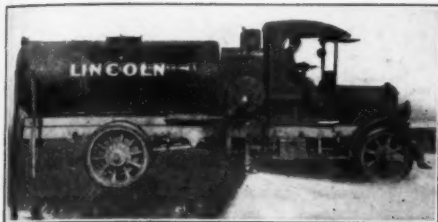


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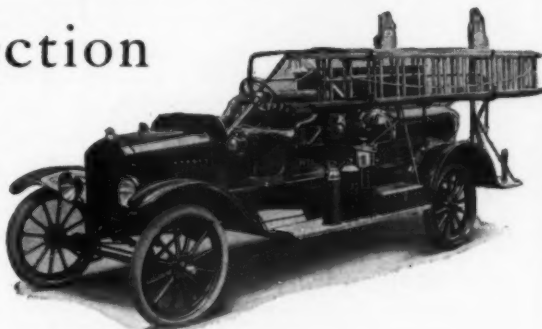
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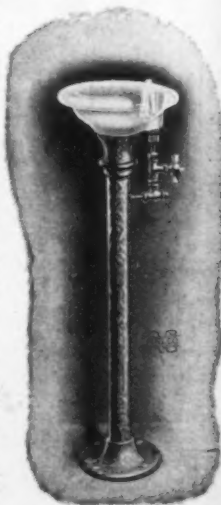
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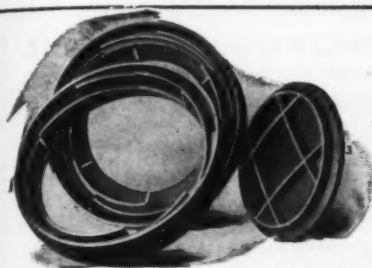
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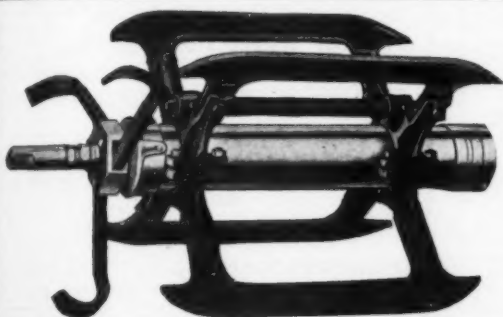
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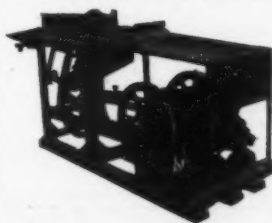
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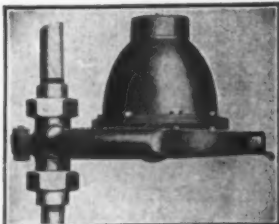
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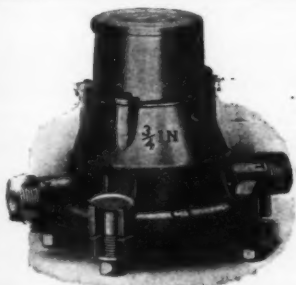
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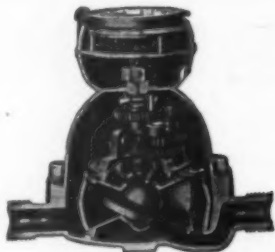
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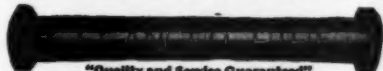
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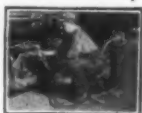
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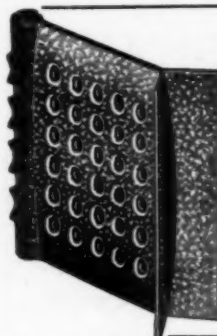


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